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ABSTRACT

As phase 2 of the long-range plan to improve the teaching/learning process for industrial arts education in North Dakota secondary schools, a project was conducted to prepare curriculum materials vital to the implementation of the suggested curriculum structure outlined in phase 1. The project objective was to develop a draft copy of a curriculum guide for industrial arts education in secondary schools. Specific goals were (1) to determine the philosophical rationale for each of the five instructional areas outlined in the suggested master plan (insights into industry and technology, graphic communication, manufacturing, construction, and energy/power), (2) to establish objectives for conducting learning activities in each of the five areas, to identify and structure the body-of-knowledge for each of the areas, (4) to develop a common format to be used in the preparation of instructional units, and (5) to develop instructional units for each of the five cluster areas. The draft copy of the curriculum guide was printed and made available to selected teachers who will be field testing during the 1976-77 academic year within eight different school settings. The report briefly describes methods and procedures, findings and analysis, and conclusions and recommendations. Most of the report consists of appendixes including an outline of the format for the instructional materials; rationale, goals, and curriculum design for the program; and draft copies of the curriculum guides for each of the five instructional areas. (HD)

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ED134822

Final Report

Development of Instructional Materials for Industrial Arts Education in North Dakota

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Department of Industrial Technology
University of North Dakota
Grand Forks, North Dakota
58202

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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December, 1976

In Cooperation with
North Dakota State Board
For Vocational and Technical Education
Bismarck, North Dakota

VE 010 053

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Preface

The development of this RCU project evolved from activities that began in North Dakota during the 1973-74 academic year when several industrial arts secondary school teachers and teacher educators initiated curriculum efforts based upon innovative programs.

Beginning in 1973 curriculum experimentation and innovation intensified as national consultants in the field of industrial arts curriculum development were brought into the State to present research findings to secondary school teachers and teacher educators. The principal consultants were Dr. Ralph Steeb (Industrial Arts Supervisor in Florida), Dr. Donald Lux (The Ohio State University), Dr. Rex Nelson (Georgia Southern College), Dr. Ervin Dennis (University of Northern Iowa), and Anthony Palunbo (Bowling Green State University).

A series of workshops and/or in-service courses were held throughout North Dakota as a follow-up of the consultant's activities in industrial arts education. These inservice experiences prepared teachers to recognize the need for change. Consequently, teachers involved became interested and committed to the need for improvement of the industrial arts curriculum for secondary schools in North Dakota.

Also, during 1975, a "master plan" committee was appointed for the purpose of developing a Suggested Master Plan For Industrial Arts Education in North Dakota. This project was funded through the North Dakota State Board For Vocational Education. It was an attempt to develop a state plan that would provide direction in the development, improvement, and administration of industrial arts programs in secondary schools in North Dakota.

The above mentioned plan became the guide and/or framwork from which this project derived. The "suggested master plan" served as the underlying basis for the development of instructional materials for industrial arts.

Acknowledgments

The project director wishes to thank the North Dakota State Board for Vocational Education for providing the necessary funds to support this curriculum guide writing session project. A special thanks to Dr. Donald Eshelby (Research and Curriculum Coordinator) and Mr. Ernest Breznay (State Supervisor of Industrial Arts) from the North Dakota Department for Vocational Education for their assistance and direction in the planning and operation of the project.

We are also indebted to the following secondary school industrial arts teachers and teacher educators who gave of their time and talents in the development of the curriculum guide that resulted through this project.

Secondary School Industrial Arts Teachers -

Scott Anderson	Bismarck Central High School Bismarck, North Dakota
Dave Carl	Magic City Campus High School Minot, North Dakota
Bert Egstad	Valley Junior High School Grand Forks, North Dakota
Larry Gander	Mayville High School Mayville, North Dakota
Isaac Hill	Langdon High School Langdon, North Dakota
George Kovash	Drayton High School Drayton, North Dakota
Rodney Lembke	Hazelton-Moffitt High School Hazelton, North Dakota
Robert Moore	Ben Franklin Junior High School Fargo, North Dakota
Eddie Poehls	Tolna High School Tolna, North Dakota

LeRoy Rice	Central High School Devils Lake, North Dakota
Dean Serr	Magic City Campus High School Minot, North Dakota
John Thurn	Jamestown High School Jamestown, North Dakota
Clifford Weixel	Jamestown High School Jamestown, North Dakota
Jerome Wisnewski	Lidgerwood High School Lidgerwood, North Dakota

Teacher Educators (Consultants) -

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Dr. Luvern Eickhoff	Department of Industrial Technology University of North Dakota
Dr. Clem Gruen	Department of Industrial Education Valley City State College
Dr. Don Mugan	Department of Industrial Education Valley City State College
Dr. Raymond Podell	Department of Industrial Technology University of North Dakota

Abstract

This project was phase II of a three year plan to improve the teaching/learning process for industrial arts education in North Dakota secondary schools. The total long-range plan included a three phase program: (1) development of a suggested master plan for industrial arts, (2) development of instructional materials, and (3) implementation. The phase two part of the long-rang program improvement plan major thrust was to prepare curriculum materials vital to the implementation of the suggested curriculum structure outlined in phase one.

The project objective was to develop a draft copy of the curriculum guide for the curriculum structure to be used for industrial arts education in secondary schools. The specific goals were to:

1. determine the philosophical rationale for each of the five instructional areas outlined in the suggested master plan - (a) Insights into Industry and Technology, (b) Graphic Communication, (c) Manufacturing, (d) Construction, and (e) Energy/Power.

2. establish objectives for conducting learning activities in each of the five areas.

3. identify and structure the body-of-knowledge for each of the areas.

4. develop a common format to be used in the preparation of instructional units.

5. develop instructional units for each of the five cluster areas.

Method and Procedure

The general design for the project was primarly a study group process. The nucleus of the project consisted of three distinct parts: (1) Organizational; (2) Review of instructional materials; and (3) Writing of a curriculum guide.

The organizational part consisted the establishment of the framework for the project and the identification and selection of participants. Essentially the project called for development of a draft copy curriculum guide for secondary school industrial arts programs. The director, during the organizational phase, developed the basic framework for the project. This included the basic rationale, content organizers and general format to be used throughout the project.

Fifteen junior and senior high school industrial arts teachers were selected to serve as the investigative and writing team. These were selected from a cadre of secondary school teachers who had participated in earlier EPDA curriculum improvement workshops that had been conducted in the state. The specific criteria for selection was based on their background and teaching experience related to one of the five cluster areas: (1) Insights into industry and technology; (2) Graphic Communications; (3) Manufacturing Technology; (4) Construction Technology; and Energy and Power. In addition, five teacher educators were selected to serve as consultants for the project. These were also selected on the basis of unique competencies and knowledge in one of the five cluster areas.

The review of instructional materials phase included the scanning of the curriculum materials and other literature recently developed in other states. This was essential to guide the investigative team to develop instructional materials that would be in line with national trends for industrial arts education. Numerous concepts identified were incorporated into the curriculum guide during the developmental phase.

The fifteen secondary school teachers were divided into five groups for writing phase. Each group was responsible to develop a curriculum guide for one cluster area. A format was developed to insure some degree of consistancy as to elements included for the purpose of uniformity. The content included rationale for industrial arts education as a base or foundation for the development of the five cluster units within the curriculum guide.

The draft copy of the curriculum guide was printed and made available to selected teachers who will be field testing during the 1976-77 academic year within eight different school settings. In addition, the instructional materials developed were discriminated through workshops and state meetings to interested teachers and administrators.

Finding and Analysis

School curricula at all levels of education need to be critically reviewed in the light of present cultural needs, global pressures and technological innovations. It was decided that the basic curriculum reform for industrial arts must deal with content first. However, learners need to know more than mere information. They need to know how information is gathered, identified and transformed; in short, they need to know how information is used and applied to practical problems of society. Learning therefore must involve an understanding of the methods by which fields of knowledge have been constructed. Learners should know the "hows" and "whys" or the behavioral characteristics of materials, devices and/or processes. Learners need to know the methods, the ways -- the processes -- by which factual information, once gained, is transformed into generalizations, concepts and principles. Learners need to know how to learn, how to use what they have learned and how to communicate about what they have learned.

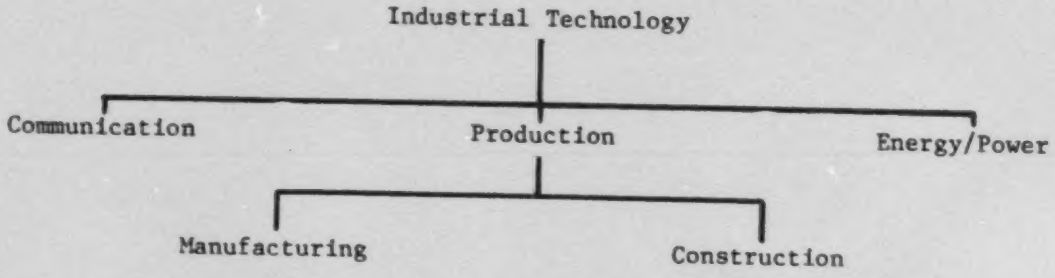
The initial step in curriculum development for industrial arts is to establish a firm basis for a total integrated program. A philosophical statement or rationale was developed which describes the values of industrial arts and the ways it can contribute to meeting the needs of students. It was decided that students need to explore and try their abilities in a variety of technological activities. They need to investigate interests and abilities, and test their self-concepts with respect to possible roles in the adult world. A well designed industrial arts program should provide exposure to a vast number of technical concepts, techniques, and occupations.

Consequently, as we engaged the question of changing industrial arts instructional materials to provide a broad exposure, it was necessary to group content into clusters to show the relationship of "parts" to the "whole." The curriculum must reflect the complex interrelationships of problem facing a technological society.

Curriculum Guide Format -- A fundamental premise of the guide is that industrial arts should draw its content from industrial technology. The basis for this premise is that industry and technology are generic terms and are interdisciplinary in nature. To structure an educational program for industrial arts it is necessary to identify the segments of industry and technology which are operationally appropriate for this subject matter field. The operational definition is:

> ... The systematized knowledge derived from the nature, the principles and practices, the products, the services, and energies employed by industry. (Delmar Olson, 1963).

This then was used as a base in the development of instructional materials for industrial arts. The industries were sub-divided into energy/power, graphic communication, production (manufacturing and construction) for the development of the guide.



Man in all stages of his technical development has been a builder, a communicator, a producer, a developer, a transporter, and an organizer. Through organization, societies formed systems or functional requisities in three major areas (1) Production, including manufacturing and construction, (2) Communications and (3) Energy/Power. These are universal technological endeavors that have developed and progressed through the years. Each has established its own body of knowledge.

Since industrial arts is the study of industry and technology, educational programs are established to transmit this body of knowledge consisting of man's technological endeavors. By definition, industrial arts education programs means those education programs (1) which pertain to the body of related subject matter, or related courses, organized for the development of understanding about the technical, consumer, occupational, recreational, organizational, managerial, social, historical, and cultural aspects of industry and technology. The learning experiences include activities such as experimenting, designing, constructing, evaluating, and using tools, machines, materials, and processes which provide opportunities for creativity and problem solving and assisting individuals in making of informed and meaningful occupational choices.

To insure the inclusion of these concepts it was necessary to identify the general curriculum elements for industrial arts education. Those elements identified were:

1. Rationale for Industrial Arts
2. Objectives of Industrial Arts
3. Curriculum Structure
4. Learning Experiences (general)

Once the general foundation was established, attention was directed at identifying the elements to be included for each of the five major cluster areas. These elements included:

1. Rationale for Cluster Area
2. Objectives of Cluster Area
3. Cluster Area Knowledge Structure
4. Body of Knowledge
5. Major Units (listing)
   - Title of Unit
   - Objectives of Unit
   - Selected Student Competencies
   - Sample Learning Activities
   - Selected Resources
   - Instructional Aids

A major portion of each guide is devoted to selected student competencies and sample learning activities for the program offerings. The competencies describe the knowledge, skills, and attitudes which students should be able to acquire upon completion of an activity and/or unit.

Student master objectives and attain competence through successful participation in learning activities. The learning activities should be carefully selected to insure that they will enable the student to master expected outcomes. An analysis of the expected competencies and associated objectives will assist the teacher to select additional student learning activities which call for understanding and applications of knowledge and skill to practical laboratory and classroom learning experiences.

Conclusion and Recommendations

Regardless of the process used for curriculum development, no curriculum is ever complete nor can it remain static. It must be flexible, it must be constantly changed and augmented; and it must prepare the learner for change.

The curriculum for industrial arts is designed not as collections of independent bits of knowledge, not as isolated and static subjects learned in a vacuum. Instead, the curriculum must reflect the complex interrelationships and processes inherent in man's technological endeavors.

The purpose of the curriculum guides is to assist industrial arts teachers in the development of a planned program that reflects the changing philosophy and practices in industrial arts education as well as incorporating the effects of technological changes. It is hoped that teachers will prepare courses at the secondary level that reflect the standards for industrial arts as set forth in the guides developed.

The curriculum guides are designed specifically to help teachers plan programs to help the learner to understand a technological culture. Also, plan activities that will assist individuals in the making of informed and meaningful career choices.

Since the guide provides a framework and direction for local curriculum development, it was recognized that change in actual programs would be an evolutionary process involving acceptance and extensive efforts on the part of industrial arts teachers and their administrators.

It is therefore recommended that phase-in process include the following parts.

1. Awareness - Teachers must be made aware of the curriculum effort.
2. Inservice Education - Teachers must prepare themselves to successfully implement the proposed curriculum.

3. Field Testing - The materials develop must be field tested to determine suitability of content.
4. Evaluation - An on-going evaluation must take place to insure it's effectiveness.
5. Area Training Sessions - Provide opportunities for teachers to obtain competencies unique to this instructional approach.
6. Similar Curriculum efforts should be attributed to the industrial arts upper division courses.

Selected References

1. A Guide to Improving in Industrial Arts, American Vocational Association, Washington, D.C., 1968.

2. A Means of Preparing Youth to Understand and Contribute to our Industrial Technological Society American Industrial Arts Association, Washington, D.C., 1976.

3. Career Education: New Perspectives for Industrial Arts, American Vocational Association, Washington, D.C., 1974.

4. Curriculum Guides for Grades 9, 10, 11, or 12, (Cluster Guides) Louisiana State Department of Education, 1974.

5. Guides on Industrial Arts, (American industry, construction, manufacturing, graphic communications), Department of Education, Tallahassee, Florida, 1973.

6. Guidelines for Industrial Arts in Career Education, American Vocational Association and American Industrial Arts Association Task Force, United States Office of Education, Grant #0E6-0-72-4505.

7. Olson, Delmar W., Industrial Arts and Technology, Prentice-Hall, Englewood Cliffs, New Jersey, 1963.

8. Industrial Education in Minnesota - A Guide for Elementary and Secondary Program Development, Minnesota State Department of Education, 1974.

9. Pre-Vocational Industrial Arts Curriculum Guides, (American Industry, Construction, Manufacturing, Graphic Communications, Power and Transportation), Idaho State Board for Vocational Education, 1975.

10. The Conceptual Base for Industrial Education Project, (3 cluster guides), The Kansas State Department of Education, 1974.

11. The Iowa Guide for Curriculum Improvement in Industrial Arts, K-12, (a study of Industrial Technology), Iowa State Department of Public Instruction, 1975.

12. The Secondary Exploration of Technology Project, (cluster guides on power conversion and transmission systems, industrial communications systems and material analysis and processing systems), School of Technology, Kansas State College, Pittsburg, Kansas, 1974.

13. The Wisconsin Guide to Local Curriculum Improvement in Industrial Education, K-12, Wisconsin State Department of Public Instruction, 1974.

Appendices

NORTH DAKOTA INDUSTRIAL ARTS
RCU CURRICULUM CONFERENCE
April 9 & 10, 1976

AGENDA:

April 9, 1976

8:00 P.M.	Orientation -- North Dakota Industrial Arts Curriculum Scope and Sequence Model.
8:30 P.M.	Discussion on Curriculum Goals: Career and Industrial Technological.
9:00 P.M.	Review of Program Content
9:30 P.M.	Formulation of sub-committees and Establish Writing Session Dates.
10:00 P.M.	Adjournment

April 10, 1976

8:30 A.M.	Development of Format for Curriculum Materials to be developed. - Learning Domains - Selected Student Competencies - Sample Learning Activities
9:00 A.M.	Sub-committee Sessions - Refine Topical Outline - Rationale and Goals - Sequence of Courses
10:15 A.M.	Break
10:30 A.M.	Sub-committee Sessions - Identifying selected student learning competencies
12:00 Noon	Lunch
1:00 P.M.	Identify Selected Learning Activities for Areas
2:30 P.M.	Sub-committee Reports:
	2:30 - 2:45 Insights Into Industry and Technology
	2:45 - 3:00 Manufacturing Technology
	3:00 - 3:15 Graphic Communications
	3:15 - 3:30 Construction Technology
	3:30 - 3:45 Energy and Power
3:45-4:00	Summary and Assignments

NORTH DAKOTA INDUSTRIAL ARTS
SECONDARY SCHOOL CURRICULUM PROJECT

Director: Myron Bender
University of North Dakota

Sub-committees, Participants and Consultants:

1. Insights Into Industry and Technology Cluster

- Jerome Wisnewski
  Lidgerwood High School
- Eddie Poehls
  Tolna High School
- Don Mugan, Consultant
  Valley City State College

2. Manufacturing Technology Cluster

- Larry Gander
  Mayville High School
- John Thurn
  Jamestown High School
- Bert Egstad
  Valley Jr. High School, Grand Forks
- Raymond Podell, Consultant
  University of North Dakota

3. Graphic Communications Technology

- Robert Moore
  Fargo Public Schools
- David Carl
  Magic City Campus - Minot
- Clifford Weixel
  Jamestown High School
- Clem Gruen, Consultant
  Valley City State College

4. Construction Technology Cluster

- LeRoy Rice
  Central High School, Devils Lake
- Isaac Hill
  Langdon High School
- Dave Carl
  Magic City Campus - Minot
- George Kovash
  Drayton High School
- Luvern Eickhoff, Consultant
  University of North Dakota

5. Energy and Power Technology Cluster

- Scott Anderson
  Bismarck High School
- Rodney Lembke
  Hazelton-Moffitt High School
- Herbert Auer, Consultant
  University of North Dakota

North Dakota Industrial Arts Curriculum Project
Lake Region Junior College
June 7-10, 1976

"Development of Instructional Materials"

Format

i Cover Design
ii Preface
iii Table of Contents

Sections:

I. Introduction to the Industrial Arts Curriculum
   (A) Rationale for Industrial Arts
   (B) Objectives of Industrial Arts
   (C) Curriculum Structure

II. Introduction to Cluster Area
   (A) Rationale for Cluster Area
   (B) Objectives for Cluster Area
   (C) Cluster Structure (Taxonometric)

III. Cluster Body of Knowledge
   (Sequential Ordering of Knowledge)

IV. Identification of Major Units

V. Elements for Each Major Unit
   (A) Title of Unit
   (B) Terminal Objective
   (C) Subordinate Units (unit outlines)
   (D) Selected Student Competencies
   (E) Selected Student Learning Activities (classroom & laboratory)
   (F) Selected Resources
      1. Textbooks
      2. Reference books
      3. Visual Aids
      4. List of Free and Inexpensive Instructional Aids

VI. Supplemental Information (coded to major units)
   (A) Transparency Masters
   (B) Student Activity Sheets
   (C) Information Sheets
   (D) Laboratory Activities

VII. Equipment and Materials Needed

VIII. Suggested Cluster Divisional Courses

SAMPLE UNITS

1. General Information
2. Cluster Areas
   - Insights into Industry and Technology
   - Graphic Communication
   - Manufacturing
   - Construction
   - Energy and Power

FOREWORD

Industrial Arts education involves the preparation, growth, and guidance of the individual student for modern living through an instructional program including the technical, consumer, occupational, recreational, organization, social, historical and cultural aspects of industry and technology. The industrial arts program provides opportunities for students in elementary and secondary education to develop an understanding of industrial-technical knowledge through creative and problem-solving learning experiences.

The learning experiences involve such activities as experimenting, planning, designing, constructing, evaluating, and using tools, machines, materials, and processes. While industrial arts utilizes and motivates universal learning experiences, its scope and sequence of courses have a direct relationship to vocational education as well as career education concepts. The instructional and laboratory experiences provide students with knowledge to help them to make wise educational and occupational choices.

This guide is one of five guides developed in an Industrial Arts Curriculum Workshop sponsored by the North Dakota State Department for Vocational Education. It is designed to provide school district personnel and industrial arts instructors with a curriculum structure and outline with related instructional materials to assist them in effectively teaching and providing occupational information and exploratory activities.

The guide should be complemented by local teacher prepared instructional materials, lesson plans, assignment sheets, progress sheets and student reference materials to enhance the instruction.

ACKNOWLEDGEMENTS

The North Dakota Industrial Arts profession is indebted to the individuals who gave of their time and talents in development of these guides.

Project Director and Consultants:

- Dr. Myron Bender, Project Director, University of North Dakota
- Mr. Ernest Breznay, State Supervisor of Industrial Arts, North Dakota State Department for Vocational Education.
- Dr. Herbert J. Auer, Consultant, University of North Dakota
- Dr. Clem Gruen, Consultant, Valley City State College
- Dr. Luvern Eickhoff, Consultant, University of North Dakota
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Mayville High SChool

Isaac Hill
Langdon High School

George Kovash
Drayton High School

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Dean Serr
Magic City Campus, Minot

John Thurn
Jamestown High School

Clifford Weixel
Jamestown High School

Jerome Wisnewski
Lidgerwood High School

Rationale for Industrial Arts

The case of any educational endeavor rest ultimately with the validity of certain basic assumptions. In the case of industrial arts, it is assumed that it is worthwhile for human beings to understand and be able to manage their environment.

Those elements which compose the physical environment which all human beings share can be divided into two general classes--natural and people-made. Study of the natural environment has a well-established place in the school science programs. The study of the people-made physical environment, which in the broadest sense, is a study of technology is seemingly of equal importance but its significance as total education and hence a part of the overall school curriculum has only recently begun to be understood.

Industrial arts is an organization of experiences designed to assist in the formation of concepts and development of insights into technology. These experiences are intended to have the learner participate actively in the conceiving, designing, planning and producing goods, using materials common to daily life. Further experienc are to enable students to gain an understanding of man's technological endeavors in energy & power, graphic communications. Therefore, the representative courses or programs include the following: (see Figure I).

NORTH DAKOTA INDUSTRIAL ARTS CURRICULUM

Program Scope and Sequence Model

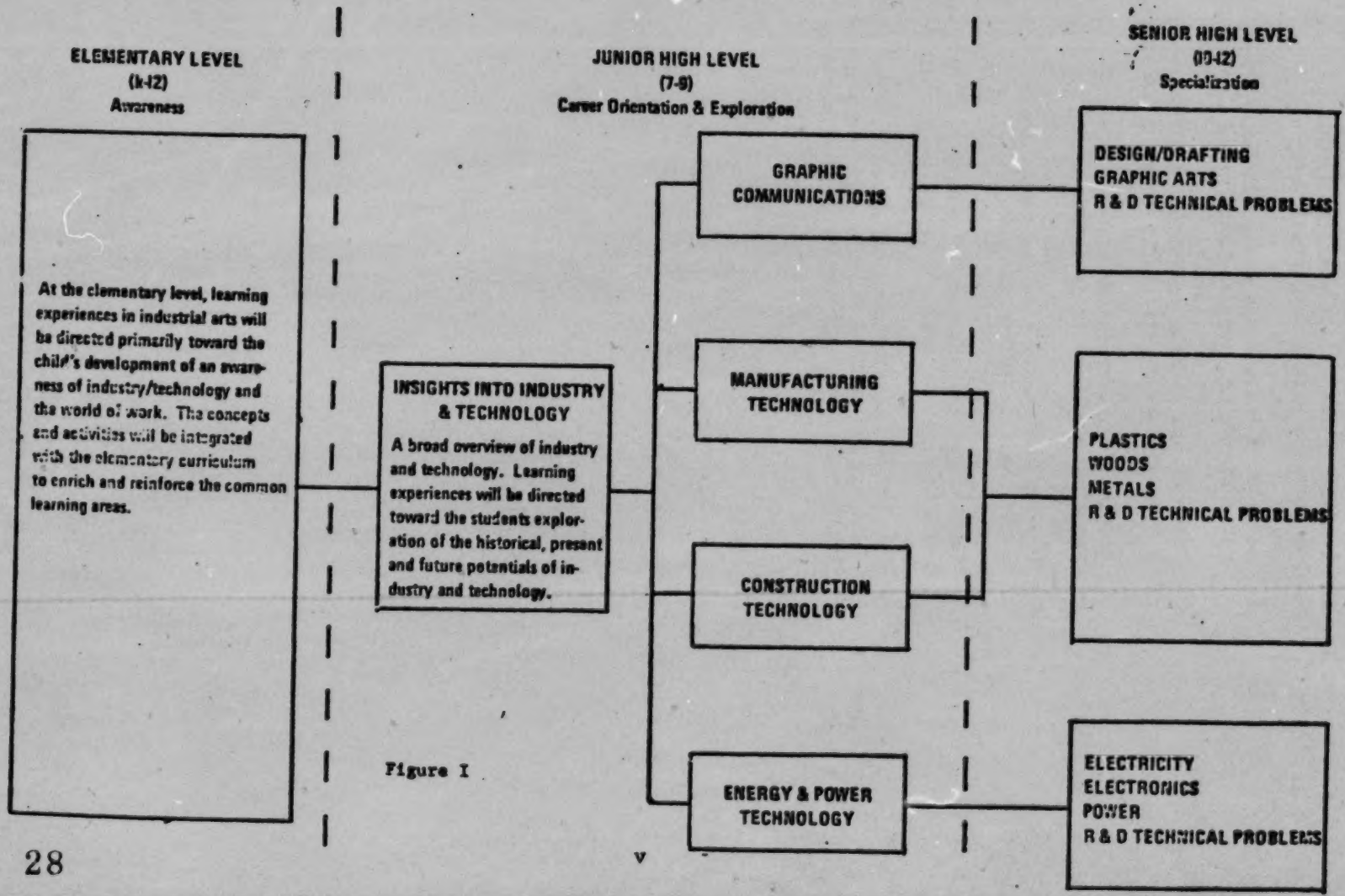

ELEMENTARY LEVEL
(k-12)
Awareness
At the elementary level, learning experiences in industrial arts will be directed primarily toward the child's development of an awareness of industry/technology and the world of work. The concepts and activities will be integrated with the elementary curriculum to enrich and reinforce the common learning areas.
JUNIOR HIGH LEVEL
(7-9)
Career Orientation & Exploration
INSIGHTS INTO INDUSTRY & TECHNOLOGY
A broad overview of industry and technology. Learning experiences will be directed toward the students exploration of the historical, present and future potentials of industry and technology.
GRAPHIC COMMUNICATIONS
MANUFACTURING TECHNOLOGY
CONSTRUCTION TECHNOLOGY
ENERGY & POWER TECHNOLOGY
SENIOR HIGH LEVEL
(10-12)
Specialization
DESIGN/DRAFTING
GRAPHIC ARTS
R & D TECHNICAL PROBLEMS
PLASTICS
WOODS
METALS
R & D TECHNICAL PROBLEMS
ELECTRICITY
ELECTRONICS
POWER
R & D TECHNICAL PROBLEMS

Figure I

Goals of Industrial Arts

Clear and realistic goals are essential in providing a sound Industrial Arts program for all students. The unique contribution of an industrial arts program focus on providing students with an opportunity to:

1. Develop an insight and understanding of industry, its place in our society, and the free enterprise system;

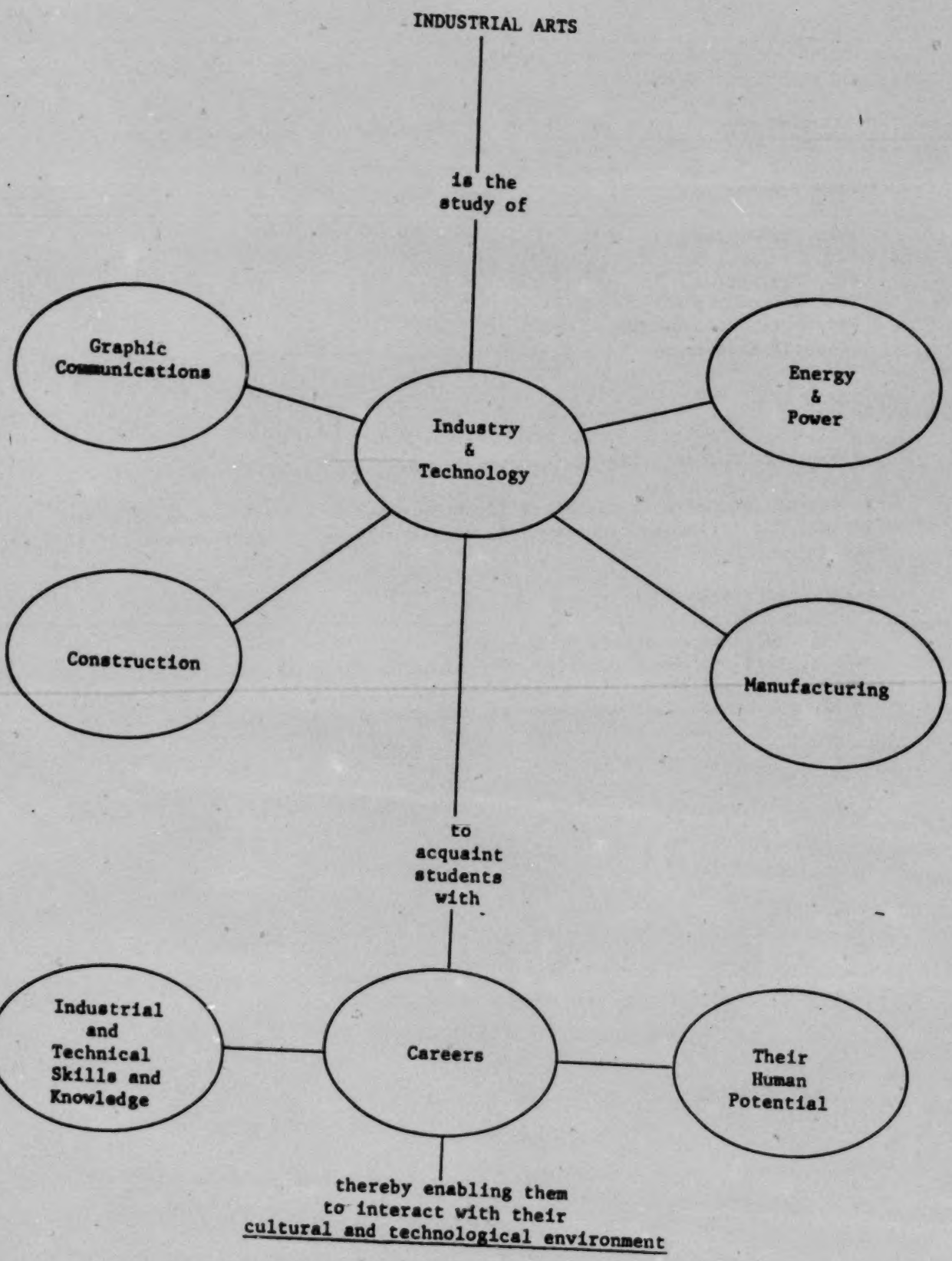
2. Discover and develop individual talents, aptitudes, interests, and potentials as related to industry and technology;

3. Develop an understanding of industrial processes and the practical application of scientific principles;

4. Develop basic skills in the proper use of common industrial tools, materials, and processes;

5. Develop problem-solving and creative abilities involving the materials, processes, and products of industry;

6. Develop an understanding of industrial and technological career opportunities and their requirements and develop those traits which will help students obtain and maintain employment.


INDUSTRIAL ARTS
is the study of
Graphic Communications
Energy & Power
Industry & Technology
Construction
Manufacturing
to acquaint students with
Industrial and Technical Skills and Knowledge
Careers
Their Human Potential
thereby enabling them to interact with their cultural and technological environment

LEARNING EXPERIENCES IN INDUSTRIAL ARTS WILL...

...Provide opportunities to identify aptitudes, abilities, and interests meaningful to CAREER SELECTION.

The student can identify and differentiate various occupations and professions associated with technology.

Student Activities:

- Mass Production
- Field Trips
- Role Playing
- Custom Production
- Personnel Organization
- Personal Assessment

...Promote TECHNICAL LITERACY in youth and adults

The student demonstrates technical literacy, insight, and knowledge that are essential for living and functioning successfully in a rapidly advancing technological society.

Student Activities:

- Using tools and materials of industry
- Identifying processes required to produce constructed and manufactured products
- Recognizing and evaluating quality of design, materials, and workmanship
- Reading, researching, and reporting information in the technical literature

LEARNING EXPERIENCES IN INDUSTRIAL ARTS WILL...

...Develop Techniques in PROBLEM SOLVING

The student demonstrates his problem solving abilities through problem analysis, ideation, prototype development, testing, and technical reporting.

Student Activities:

- Technical reports
- Planning and constructing projects
- Individual and team activities
- Design problems
- Research and development
- Simulating industrial techniques and processes
- Brainstorming
- Prototype developing and testing

...Develop basic SKILL in the use of tools and equipment

The student can properly use and care for common tools and machines.

Student Activities:

- Using hand and power tools and equipment
- Construction activities
- Custom production
- Mass production

LEARNING EXPERIENCES IN INDUSTRIAL ARTS WILL...

...Provide opportunities for REINFORCEMENT of learning in other subject areas

The student solves practical problems by the application of academic concepts and principles.

Student Activities:

Research information and planning
Performing experiments and constructing projects
Using related instructional materials
Developing related organization practices
Reading, writing, measuring, computing, and discussing during technical applicatio

...Develop SAFETY habits

The student exhibits safe practices in the laboratory and relates these to situations in the school, home, and community.

Student Activities:

Laboratory safety program
Safety committees
Self-evaluation
Safety practices

LEARNING EXPERIENCES IN INDUSTRIAL ARTS WILL...

...Develop attitudes, individual involvement, and a realistic evaluation for CONSUMER AWARENESS

The student evaluates industrial products by judging the quality of construction, the selection of materials, and the fulfillment of function.

Student Activities:

- Product evaluation
- Testing limits of materials
- Research including design and drawing
- Understanding advertising
- Applying and evaluating finishes
- Fabricating and assembling products
- Exploring industrial processes

...Provide opportunities for PERSONAL and SOCIAL growth

The student exhibits cooperation, consideration, and understanding toward others, and pride for his/her own work.

Student Activities:

- Mass production
- Club activities
- Amateur radio
- Personnel organization
- Civic activities

LEARNING EXPERIENCES IN INDUSTRIAL ARTS WILL...

...Contribute to improved RECREATION

The student, through laboratory experiences with tools and materials, makes choices of activities for recreational purposes.

Student Activities:

- Crafts
- Metalworking
- Photography
- Mechanics
- Plastics
- Electronics

INSIGHTS INTO INDUSTY AND TECHNOLOGY

STATE GUIDE

MASTERWORKS COPY

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INSIGHTS INTO INDUSTRY AND TECHNOLOGY

RATIONALE: In the absence of an elementary industrial arts curriculum there is a great need to establish a framework for the further study of industry and technology. A student should know what industry is, he should understand the impact of technology on society, he should be aware of industrial and related careers, he should know how to explore with the tools and material in a safe and logical manner. All of these are prerequisites to a study of the four industrial clusters.

The course also serves as an integrator or unifier in a course sequence of increasing specialization using industry as a whole, as the content organizer, rather than the four clusters.

In fact, the complete success of the clustering system depends upon the unified treatment of this course because the four clusters, while eliminating a great deal of fragmentation compared to the traditional system, are themselves fragments of a larger whole.

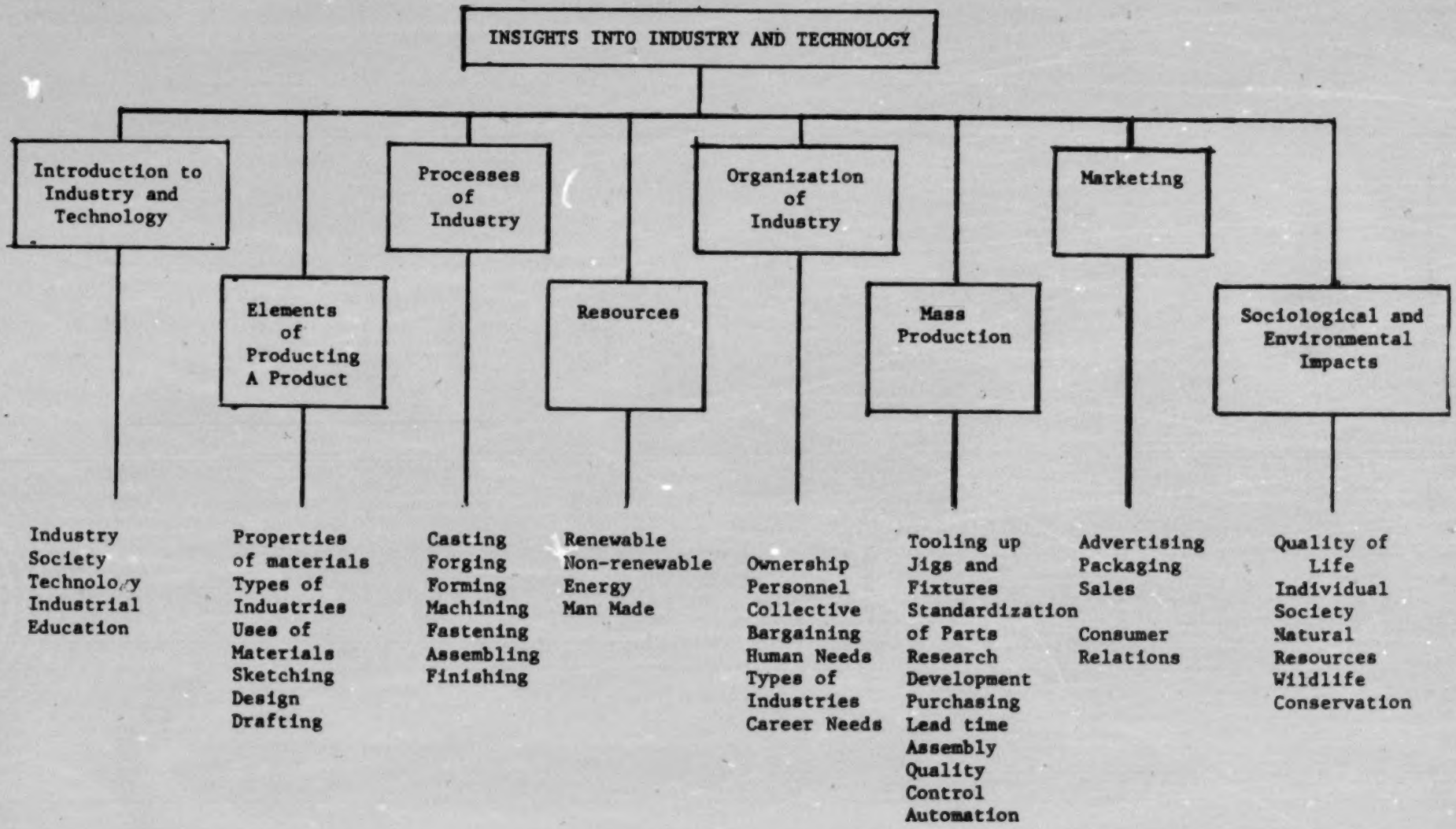
One should also be aware that even though a unified theme is used throughout the course, some units are out of natural sequence to permit a progression of activities from individual to group which is so necessary at this level.

This course is basic to the general education of all pupils even in the absence of further opportunities in industrial arts.

OBJECTIVES: Primary objectives of Insights into Industry and Technology is to assist the student:

1. To an historical perspective into the development and progress of man through the use of tools culminating in a study of modern industry.

2. To develop a concept of what industry is, and provide insights into the relationships that exist between all the common elements of industry.
3. To provide an insight into the relationships that exist between industry and society which will enable the student to survive and prosper in the resultant environment.
4. To develop an awareness and initiate an exploration of industrial and related careers.
5. To develop abilities in the safe and proper use of industrial tools and materials.
6. To provide an introduction to the study of the four industrial clusters.



II C. TAXONOMETRIC STRUCTURE

41

42

INSIGHTS INTO INDUSTRY AND TECHNOLOGY

BODY OF KNOWLEDGE

1.00 INTRODUCTION TO INDUSTRY AND TECHNOLOGY

- 1.10 Defining American Industry
  - 1.11 Definition
  - 1.12 Purpose
  - 1.13 Organization
  - 1.14 Types
- 1.20 History of Industry
  - 1.21 Home system
  - 1.22 Craft guilds
  - 1.23 Factory system
  - 1.24 Industrial Revolution
  - 1.25 Interchangability of parts
  - 1.26 Mass production
  - 1.27 Automation
- 1.30 Man's Dependence on Industry
  - 1.31 Home
  - 1.32 Job
  - 1.33 School
  - 1.34 Mobility
- 1.40 Industrial Interdependence
  - 1.41 Complexity of products
  - 1.42 Transportation
  - 1.43 Energy
  - 1.44 Sub-assemblies, sub-contracting
- 1.50 Defining Technology
  - 1.51 Definition
  - 1.52 Development of technology
  - 1.53 Technology and industry
  - 1.54 Technology and society
- 1.60 Role of the Industrial Arts Laboratory
  - 1.61 Definition of a laboratory
  - 1.62 Simulation
  - 1.63 Exploration
    - 1.631 Safety
    - 1.632 Orderliness

2.00 ELEMENTS OF PRODUCING A PRODUCT

- 2.10 Properties of Materials
  - 2.11 Hardness
  - 2.12 Brittleness
  - 2.13 Weight
  - 2.14 Flexibility
  - 2.15 Heat conductivity

- 2.20 Uses of Common Industrial Materials
  - 2.21 Woods
  - 2.22 Plastic
  - 2.23 Ferrous metals
  - 2.24 Non-ferrous metals
  - 2.25 Paper
  - 2.26 Compositions
  - 2.27 Alloys
  - 2.28 Textiles
  - 2.29 Ceramics
  - 2.30 Glass
  - 2.31 Concrete
  - 2.32 Rubber

- 2.30 The Four Types of Industries
  - 2.31 Manufacturing
  - 2.32 Construction
  - 2.33 Energy and power
  - 2.34 Graphic Communication

- 2.40 Sketching and Design Drafting
  - 2.41 Freehand sketching (orthographic)
  - 2.42 Freehand sketching (isometric)
  - 2.43 Alphabet of lines
  - 2.44 Geometrics
  - 2.45 Drafting Instruments
  - 2.46 Plate layout
  - 2.47 Centering
  - 2.48 Lettering
  - 2.49 Sample orthographic plates
  - 2.50 Dimensioning
  - 2.51 Design a project to be constructed

3.00 PROCESSES

- 3.10 Safety
  - 3.11 Personal safety
  - 3.12 Participants safety

- 3.20 Planning
  - 3.21 Layout
  - 3.22 Estimating

3.30 Tool Identification and use

3.40 Forming
- 3.41 Casting or molding
  - 3.411 One shot molding
  - 3.412 Permanent molds
- 3.42 Compressing or stretching
  - 3.421 Forging
  - 3.422 Bending
  - 3.423 Drawing
- 3.43 Conditioning material
  - 3.431 Heat conditioning
  - 3.432 Physical and mechnical deforming
  - 3.433 Chemical reactions
  - 3.434 Physical condition

3.50 Seperating
- 3.51 Shearing
- 3.52 Clip removing
- 3.53 Other processes
  - 3.531 Thermal erosion
  - 3.532 Chemical seperating
  - 3.533 Electrochemical seperating
  - 3.534 Induced fracture

3.60 Combining
- 3.61 Mixing
- 3.62 Coating
  - 3.621 Organic (varnish, lacquer, enamel)
  - 3.623 Vitreus (glass coating)
- 3.63 Bonding
  - 3.631 Fusion bonding (welder)
  - 3.632 Adhesive (glue)
- 3.64 Mechanical fasteners
  - 3.641 Thread and twine
  - 3.642 Wire and rope
  - 3.643 Others

4.00 RESOURCES NEEDED

4.10 Kinds of raw materials
- 4.11 Mineral fuels
- 4.12 Non-metallic minerals
- 4.13 Metallic minerals

4.20 Extraction
- 4.21 Surface mining
- 4.22 Underground mining
- 4.23 Drilling

4.30 Reproducible Materials
- 4.31 Plant and animal sources

4.40 Non-renewable Materials
- 4.41 All other material sources
- 4.42 Recycling
- 4.43 Conservation of our resources

4.50 Types of Energy
- 4.51 Mechanical
- 4.52 Radiant
- 4.53 Chemical
- 4.54 Heat
- 4.55 Electrical
- 4.56 Nuclear

4.60 Man Made Materials (Synthetics)

4.70 Converting Raw Materials
- 4.71 Preparation for refining
- 4.72 Refining
  - 4.721 Resultant by-products
- 4.73 Controlling quality
- 4.74 Bulking
- 4.75 Converting
  - 4.751 Preparation for converting
  - 4.752 Ways of converting

5.00 ORGANIZATION OF INDUSTRY

5.10 Ownership of Industry
- 5.11 Private
- 5.12 Cooperative
- 5.13 Public

5.20 Personnel of Industry
- 5.21 Managerial
  - 5.211 Planning
  - 5.212 Organizing
  - 5.213 Controlling
- 5.22 Labor (non-managerial)
  - 5.221 Hiring
  - 5.222 Training
  - 5.223 Working
  - 5.224 Advancing
  - 5.224 Retiring

5.30 Collective Bargaining
- 5.31 Laws
- 5.32 Employers
- 5.33 Employee
- 5.34 Grievance procedures
  - 5.341 Negotiation
  - 5.342 Mediation
  - 5.343 Arbitration
  - 5.344 Strike

5.40 Types of Industries
- 5.41 Manufacturing
- 5.42 Construction
- 5.43 Graphic communication
- 5.44 Energy and power

5.50 Human Needs
- 5.51 Physical needs
  - 5.511 Necessities of life
    - 5.5111 Regularity of work
- 5.52 Security needs
  - 5.521 Organized living (not too much uncertainty)
- 5.53 Love needs
  - 5.531 Need to be needed
  - 5.532 Need to be appreciated
  - 5.533 Need to belong
- 5.54 Esteem needs
  - 5.541 Respect
    - 5.5411 Self respect
    - 5.5412 Respect from others
- 5.55 Self-fulfillment needs
  - 5.551 Desire to become what one can be

5.60 Career Needs
- 5.61 Educational requirements
- 5.62 Working conditions
- 5.63 Location of work
- 5.64 Regularity of work
- 5.65 Working hours
- 5.66 Chances of advancement

6.00 MASS PRODUCTION

6.10 Standardization of Parts

6.20 Research and Development
- 6.21 Designing
- 6.22 Costs and profits

6.30 Purchasing
- 6.31 Volumes and discounts

6.40 Lead time
- 6.41 Capital outlay

6.50 Tooling up
- 6.51 Jigs and fixtures
- 6.52 Time studies
- 6.53 Flow charts
- 6.54 Materials handling
- 6.55 Production control

6.60 Assembly
6.61 Sub-assemblies

6.70 Quality control

6.80 Automation

7.00 MARKETING OF PRODUCTS

7.10 Advertising
7.11 Graphics
7.12 Communications
7.13 Profits

7.20 Packaging
7.21 Package fabrication
7.22 Package graphics
7.23 Transportation
7.231 Truck
7.232 Rail
7.233 Air
7.234 Water
7.24 Displaying

7.30 Sales
7.31 Industry to industry
7.32 Consumer direct
7.33 Wholesalers
7.34 Retailers
7.341 Mail order houses
7.342 Telephone sales
7.343 Discount houses
7.344 Department stores

7.40 Consumer Relations
7.41 Servicability
7.42 Warrenties
7.43 Guarantees

8.00 SOCIAL AND ENVIRONMENTAL IMPACT

8.10 Quality of Life
8.11 Job life
8.111 Craftsmanship
8.112 Advancements
8.1121 Responsibilities
8.1122 Earnings
8.1123 Relocation
8.113 Government Regulations
8.1131 Health restrictions
8.1132 Compulsory retirement

MAJOR UNITS

INSIGHTS INTO INDUSTRY AND TECHNOLOGY

1.00 INTRODUCTION TO INDUSTRY AND TECHNOLOGY . . . . . 2 Days

2.00 ELEMENTS OF PRODUCING A PRODUCT . . . . . 15 Days

3.00 PROCESSES OF INDUSTRY . . . . . 35 Days

4.00 RESOURCES . . . . . 5 Days

5.00 ORGANIZATION OF INDUSTRY . . . . . 10 Days

6.00 MASS PRODUCTION . . . . . 10 Days

7.00 MARKETING . . . . . 10 Days

8.00 SOCIOLOGICAL AND ENVIRONMENTAL IMPACTS OF INDUSTRY AND TECHNOLOGY . . . . . 3 Days

UNIT I

1.00 INTRODUCTION TO INDUSTRY AND TECHNOLOGY 2 Days

OBJECTIVES: At the end of this unit the student will be able to:

A. demonstrate an understanding of what industry is and how it meets mans needs

B. demonstrate an understanding of what technology is and how it is used in industry.

UNIT OUTLINE

1.10 Defining American Industry

1.11 Definition

1.12 Purpose

1.13 Organization

1.14 Types

1.20 History of Industry

1.21 Home system

1.22 Craft guilds

1.23 Factory system

1.24 Industrial Revolution

1.25 Interchangability of parts

1.26 Mass production

1.27 Automation

1.30 Man's Dependence on Industry

1.31 Home

1.32 Job

1.33 School

1.34 Mobility

1.40 Industrial Interdependence

1.41 Complexity of products

1.42 Transportation

1.43 Energy

1.44 Sub-assemblies, sub-contracting

1.50 Defining Technology

1.51 Definition

1.52 Development of technology

1.53 Technology and industry

1.54 Technology and society

1.60 Role of the Industrial Arts Laboratory

1.61 Definition of a laboratory

1.62 Simulation

1.63 Exploration

1.631 Safety

1.632 Orderliness

UNIT NO. I	SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
1.00	INTRODUCTION TO INDUSTRY AND TECHNOLOGY THE STUDENT WILL BE ABLE TO:	1.10-1.70 FOR THE SCHOOL LAB. Write a report explaining how technology has freed man from drudgery and improved his lifestyle.
1.10	Orally or in writing define one or more aspects of industry.	Write an analysis of a peice of equipment found in the home in terms of the different technologies and industries needed to produce it.
1.20	Trace orally or in writing the progress of industrial development.	Initiate a group discussion as to the importance of each major cluster of industries by asking students to imagine life without each one in turn.
1.30	Discuss orally or in writing man's dependence on industry using examples he is familiar with.	Students collect newspaper clippings relating to man's dependence on industry, and the affect of industry on man.
1.40	Discuss industrial interdependence by refering to a single laboratory machine.	Students collect newspaper ads of locally manufactured products.
1.50	Define one or more of the aspects of technology.	
1.60	Connect verbally or in writing the school laboratory and industry.	

1.00 SELECTED RESOURCES

TEXT: Miller, Wilbur R., Marion E. Maddox, and Lavon B. Smith, Exploring Careers in Industry, Second Edition. McKnight and McKnight Publishing Company, Bloomington, Illinois, 1975. (Chapter 1)

REFERENCES: Wagner, Willis H., Modern Industry. American Technical Society, Chicago, Illinois, 1975. (Chapter 1)

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Olson, Delmar W., Tecnol-O-Gee, Industrial Arts--Interpreter of Technology for the American School. Office of Publications, School of Education, North Carolina State University, Raleigh, NC., 1973.

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GRAPHIC COMMUNICATIONS

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GRAPHIC COMMUNICATION

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TAXONOMETRIC STRUCTURE.....2
BODY OF KNOWLEDGE.....4
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UNIT II FREEHAND.....2.1
UNIT III INSTRUMENT.....3.1
UNIT IV ELEMENTS OF DESIGN.....4.1
UNIT V IMAGE GENERATION.....5.1
UNIT VI PREPRODUCTION.....6.1
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GRAPHIC COMMUNICATIONS

RATIONALE: Graphic Communications is the process of transmitting visually, ideas, thoughts, or concepts.

A study of Graphic Communications provides an exploratory experience that develops an awareness and understanding of the drafting and graphic arts industries. It provides opportunities for all students to develop an insight into economic, social and recreational aspects of visual communications in a changing society.

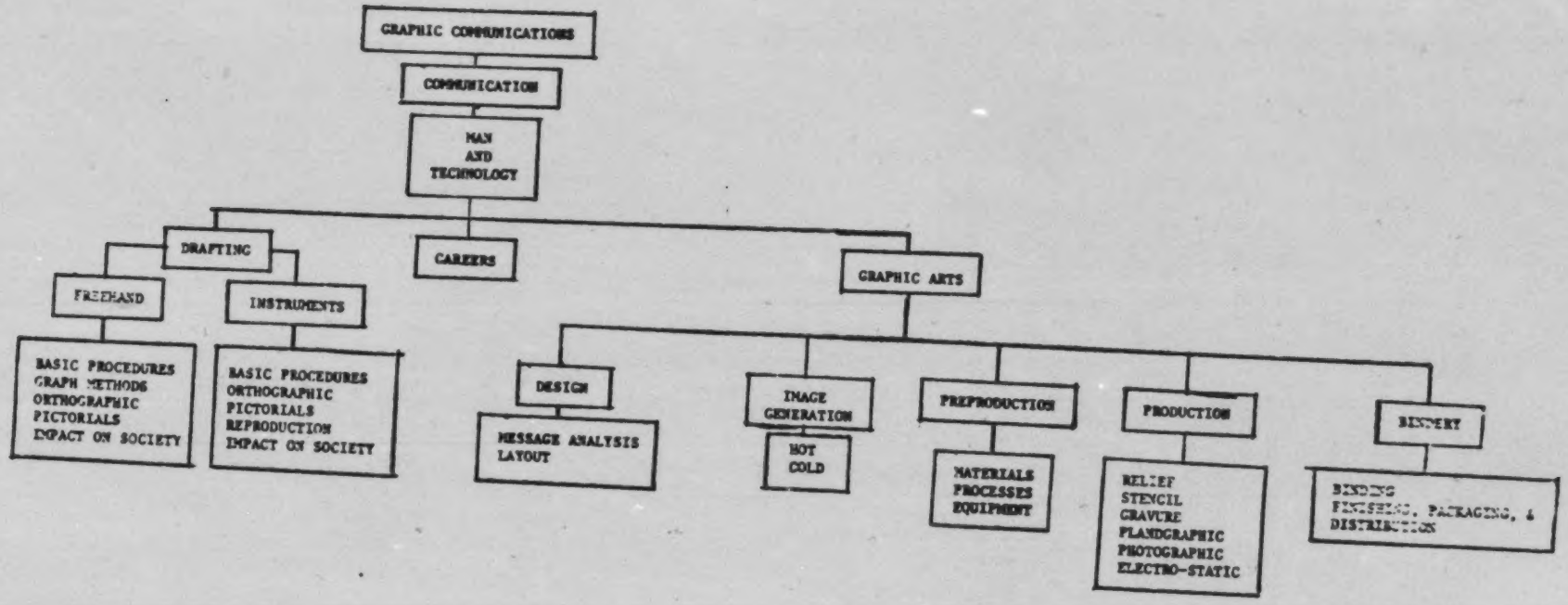
Graphic Communications involves students in meaningful class and instructional activities and develop self-direction, continuous learning, and creativity.

OBJECTIVES: Primary objectives of Graphic Communications are to assist the student:

1. To develop an insight and understanding of the drafting and graphic arts industry and technology and its place in our society.
2. To develop problem solving and creative abilities using freehand and instrument drafting processes.
3. To discover and develop an insight and understanding of the graphic arts industry through the study of design, image generation, pre-production, production, and bindery.

4. To develop career awareness, exploratory experiences and information dealing with the Graphic Communications industry.

5. To become an effective consumer and/or producer in a Graphic Communications society.



GRAPHIC COMMUNICATIONS
TAXONOMETRIC STRUCTURE

GRAPHIC COMMUNICATION

BODY OF KNOWLEDGE

1.00 COMMUNICATION

- 1.10 Communication and Man
  - 1.11 Evolution of communication
  - 1.12 Communication model
    - 1.121 The model
  - 1.13 Social impacts of communication
  - 1.14 Cultural impacts of communication
- 1.20 Communication and Technology
  - 1.21 Origins of the graphic reproduction industry
  - 1.22 The middle ages and industrial revolution
  - 1.23 Graphics to the present
  - 1.24 The future of graphic communications

2.00 FREEHAND

- 2.10 Basic Procedures
  - 2.11 Tools
    - 2.111 Pencils
      - 2.1111 Mechanical
      - 2.1112 Wood
    - 2.112 Erasers
      - 2.1121 Artist
      - 2.1122 Ruby
      - 2.1123 Electric
    - 2.113 Paper
      - 2.1131 Tracing
      - 2.1132 Vellum
      - 2.1133 Tracing cloth
      - 2.1134 Glass cloth
      - 2.1135 Film
  - 2.12 Lines
    - 2.121 Alphabet of lines
    - 2.122 Construction
      - 2.1221 Straight lines
      - 2.1222 Circles and arcs
      - 2.1223 Curves
  - 2.13 Lettering
    - 2.131 Gothic
      - 2.1311 Vertical
      - 2.1312 Inclined
    - 2.132 Others
- 2.20 Graph Methods
  - 2.21 Enlarged
  - 2.22 Reduced
  - 2.23 Copy

- 2.30 Orthographic
  - 2.31 Thumbnail
  - 2.32 One view
  - 2.33 Multiview
  - 2.34 Working
- 2.40 Pictorials
  - 2.41 Isometric
    - 2.411 First position
    - 2.412 Second position
    - 2.413 Reversed
  - 2.42 Oblique
    - 2.421 Cabinet
    - 2.422 Cavelier
  - 2.43 Perspective
    - 2.431 1 point
    - 2.432 2 point
    - 2.433 3 point
- 2.50 Impact on Society
  - 2.51 Artistic
    - 2.511 Artist
    - 2.512 Advertising
    - 2.513 Fashion
    - 2.514 Cartoonist
  - 2.52 Technical
    - 2.521 Designer
    - 2.522 Engineer
  - 2.53 Recreational
    - 2.531 Individual

3.00 INSTRUMENT

- 3.10 Basic Procedures
  - 3.11 Tools and equipment
  - 3.12 Techniques
    - 3.121 Uses
    - 3.122 Safety
  - 3.13 Alphabet of lines
  - 3.14 Geometric construction
  - 3.15 Lettering
- 3.20 Orthographic
  - 3.21 Theory of shape description
  - 3.22 Dimensioning
    - 3.221 Aligned
    - 3.222 Unidirectional

- 3.23 Scale drawing
  - 3.231 Metric
  - 3.232 Architect
  - 3.233 Engineering
  - 3.234 Civil
- 3.24 Types
  - 3.241 Auxiliary
  - 3.242 Detail
  - 3.243 Assembly
  - 3.244 Pattern

- 3.30 Pictorial
  - 3.31 Isometric
    - 3.311 First position
    - 3.312 Second position
    - 3.313 Reversed
  - 3.32 Oblique
    - 3.321 Cavalier
    - 3.322 Cabinet
  - 3.33 Perspective
    - 3.331 1 point
    - 3.332 2 point
    - 3.333 3 point
  - 3.34 Presentation
    - 3.341 Assembly
    - 3.342 Illustrative

- 3.40 Reproduction
  - 3.41 Blueprint
  - 3.42 Zerox
  - 3.43 Microfilm
  - 3.44 Computer
  - 3.45 Photographic

- 3.50 Industrial impact on society
  - 3.51 Areospace
  - 3.52 Architectural
  - 3.53 Charts and graphs
  - 3.54 Electrical
  - 3.55 Engineering
  - 3.56 Map
  - 3.57 Metal

4.00 DESIGN

- 4.10 Message Analysis
  - 4.11 What is the message?
  - 4.12 Why send a message?
  - 4.13 To who?
  - 4.14 When?
  - 4.15 How?
  - 4.16 Where?

4.20 Layout
- 4.21 Typography
- 4.22 Drafting the layout
  - 4.221 Thumbnail
  - 4.222 Rough
  - 4.223 Comprehensive
  - 4.224 Mechanical

5.00 IMAGE GENERATION

5.10 Hot
- 5.11 Metal type
- 5.12 Wood type
- 5.13 Relief form to film conversions

5.20 Cold
- 5.21 Strike on
- 5.22 Clip art and press on
- 5.23 Illustrations
- 5.24 Photo composition
- 5.25 Continuous tone photography
- 5.26 Mechanical (relief)

6.00 PREPRODUCTION

6.10 Materials
- 6.11 Inks
- 6.12 Paper

6.20 Processes
- 6.21 Proofreading
- 6.22 Film types
- 6.23 Stripping
- 6.24 Plate making

6.30 Equipment
- 6.31 Process camera
- 6.32 Presses

7.00 PRODUCTION

7.10 Relief
- 7.11 Letterpress

7.20 Stencil
- 7.21 Paper
- 7.22 Handcut
- 7.23 Photographic

7.30 Gravure

7.40 Planographic
- 7.41 Lithographic
- 7.42 Spirit duplicating

7.50 Continuous Tone Photography
- 7.51 Black and White
- 7.52 Color

7.60 Electro-Static

8.00 BINDERY

8.10 Binding
- 8.11 Folding
- 8.12 Cutting
- 8.13 Drilling
- 8.14 Gathering
- 8.15 Methods

8.20 Finishing, Packaging and Distribution
- 8.21 Finishing a project
- 8.22 Packaging procedures
- 8.23 From bindery to customer

9.00 CAREERS

9.10 Classifications
- 9.11 Occupations
  - 9.111 Management
  - 9.112 Labor
    - 9.1121 Design
    - 9.1122 Sales
    - 9.1123 Research and development
    - 9.1124 Service personnel
    - 9.1125 Technical personnel

9.20 Career Opportunities in the Industry
- 9.21 Preparation
- 9.22 Economics
- 9.23 The future

GUIDELINES FOR IMPLEMENTATION

This instructional guide is designed to assist teachers, supervisors, administrators, and teacher-educators as they organize an industrial course in the Graphic Communications cluster in the State of North Dakota. The implementation of the cluster approach is going to require the cooperation of all with an interest in quality education in our state, because it is going to mean changing from traditional habits and philosophies to thinking of industrial arts as total concept.

The Graphic Communications cluster of drafting and graphic arts is presented here as a suggested guide for this new approach to industrial arts in North Dakota. The committee that developed this guide would recommend that the teacher not dispence with the project in his instruction, but instead, rethink the use of this project as a vehicle to develop the basic concepts. For example, the design of a project, the images generated, the pre-production exercises, the production exercise, and binding it can and should probably be carried out with a single project.

For those not familiar with Graphic Communications, the committee has provided suggested procedures, projects, techniques, equipment, supply lists, and audio-visual aids to help those who would have a difficult time developing their own materials. The committee is fully aware of the fact that the school day is limited in time and the vast amount of available material. We know, however, that the professional teachers in the field will choose those concepts most

applicable to his or her school and at the same time apply the concepts of Graphic Communications to the total field of industrial arts.

MAJOR UNITS

GRAPHIC COMMUNICATIONS

1.00	COMMUNICATIONS	5 Days
2.00	FREEHAND	15 Days
3.00	INSTRUMENT	15 Days
4.00	DESIGN	5 Days
5.00	IMAGE GENERATION	5 Days
6.00	PREPRODUCTION	10 Days
7.00	PRODUCTION	25 Days
8.00	BINDERY	5 Days
9.00	CAREERS	5 Days

UNIT I

1.00 COMMUNICATION 5 Days

OBJECTIVE: To develop an understanding of how man began and has advanced the process of transmitting visually the ideas, thoughts, and concepts of one person to another.

1.10 Communication and Man

At the end of this unit, the student will be able to:

A. identify the significant steps in the evolution of communication

B. describe in detail a communication model and explain how it works

C. relate in writing the social and cultural impact of communication on society.

UNIT OUTLINE

1.11 Evolution of communication

1.12 Communication model

1.121 The model

1.13 Social impacts of communication

1.14 Cultural impacts of communication

SELECTED RESOURCES

TEXT: Dennis, Ervin and Jenkins, John D. Comprehensive Graphic Arts. Howard W. Sams & Co., Inc., Indianapolis, Indiana, 1974. (Chapters 1, 2, 3, 4, 5, 6)

RESOURCES: Hauenstien, A. Dean and Bachmayer, Steven A. The World of Communications Visual Media. McKnight & McKnight Publishing Co., Bloomington, Illinois, 1974. (Chapter 1)

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Turnbull, Arthur T. and Baird, Russell N. The Graphics of Communication. Holt, Rinehart and Winston, Inc., New York, N. Y., 1968. (Chapter 1, 2)

1.20 Communication and Technology

At the end of this unit, the student will be able to:

A. describe the impact of technology on communication.

UNIT OUTLINE

1.21 Origins of the graphic reproductions industry

1.22 The middle ages and the industrial revolution

1.23 Modern graphics

1.24 The future of Graphic Communications

SELECTED RESOURCES

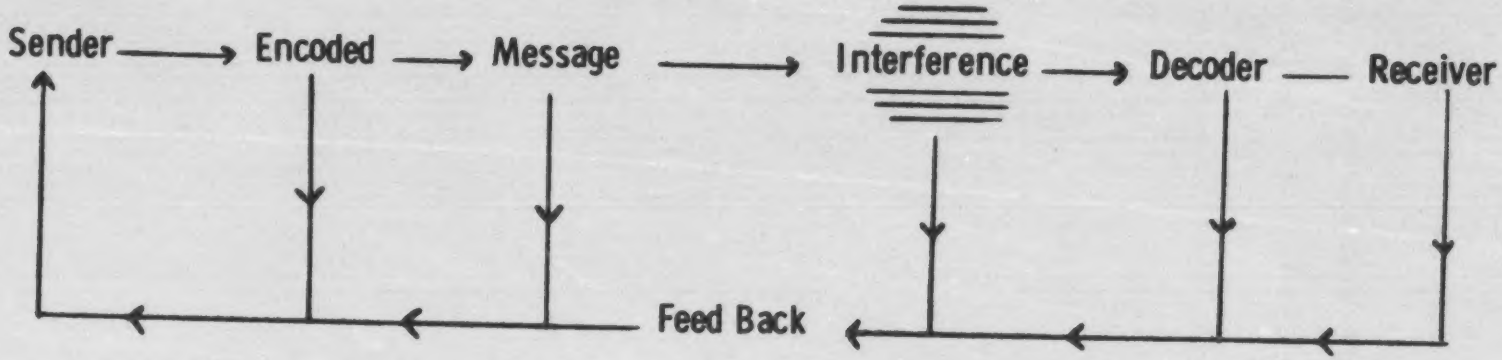
TEXT: Dennis, Ervin and Jenkins, John D. Comprehensive Graphic Arts. Howard W. Sams & Co., Inc., Indianapolis, Indiana, 1974. (Chapters 1, 2, 3, 4, 5, 6, 7, 8, 9)

RESOURCES: Broekhuizen, Richard J. Graphic Communications. McKnight & McKnight Publishing Co., Bloomington, Illinois, 1973. (Section 1)

Turnbull, Arthur T. and Baird, Russell N. The Graphics of Communication. Holt, Rinehart and Winston, Inc., New York, N. Y., 1968. (Chapter 3)

UNIT NO. I	SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
1.00	COMMUNICATIONS THE STUDENT WILL BE ABLE TO:	
1.10	A. Describe and compare the advancement of technology and communication.	A1. Construct and display methods of communication.
	B. Use properly the nomenclature associated with graphic communications.	B1. Construct the origins of alphabets.
	C. Demonstrate effective means of conveying an idea using presentation materials.	C1. Construct communications model in classroom.
	D. Apply the theories of visual organization.	
1.20	A. Demonstrate the interrelationship of drafting and graphic arts as used in industry.	A2. Discuss the future of communications.

COMMUNICATION MODEL



73

74

1.00 VISUAL AIDS

FILM STRIPS: Visual Communications, CBIE slide series, Kansas state plan.

Worlds With In Worlds, Audio Visual Distribution Department, Eastman Kodak.

Ideas Won't Keep, Audio Visual Distribution Department, Eastman Kodak

MANUFACTURING TECHNOLOGY

STATE GUIDE

MASTER WORK COPY

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MANUFACTURING TECHNOLOGY

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MANUFACTURING TECHNOLOGY

RATIONALE: The concept of manufacturing is defined to include all those activities related to the production of goods and services to meet the wants and needs of man. It is a concept that has been in existance as long as man himself. Eventhough manufacturing or securing of goods for survival of early man may have been quite simple in modern context, the concept did exist. In this context the concept of manufacturing is fundamental to the existance of man and supported by other related areas.

The concept of manufacturing has three main general elements; those of input which includes an enterprise system, resources, and personnel; those of material processes which includes processing raw material resources to standard materials, casting, forming, shaping, subtracting, combining, and finishing; and the element of output for a needed and desirable product. These elements seemed basic to manufacturing industries with better exception to their complexity.

OBJECTIVES: The objectives of Manufacturing Technology instruction is the study of information and occupations, utilizing a variety of materials. It should provide an opportunity for each student to become familiar with the industrial society. The study of the manufacturing industry will help each student understand the nature of work in manufacturing industries. It will include the managed use of tools, materials, and processes needed in the manufacturing phase of industries.

Primary objectives of Manufacturing Technology are to assist the student:

1. To place Manufacturing Technology in the broader context of industrial technology and all of technology.
2. To be aware of the history, present character, and future of the manufacturing phase of industry.
3. To appreciate, understand, and perform selected management practices in planning, organizing, and controlling as they relate to manufacturing production systems.
4. To appreciate, understand, and perform selected personnel practices of hiring, training, working, advancing, and retiring as they relate to a managed production system in manufacturing.
5. To appreciate, understand, and perform selected production practices in preprocessing, processing, and postprocessing or servicing as they apply to manufacturing production systems.
6. To appreciate and understand the interrelationships within and between management, personnel, and production practices.
7. To appreciate and have some understanding of characteristics, quality, and use of manufactured products and the tools and materials utilized in their manufacture.
8. To utilize, the knowledge and skills of manufacturing management and production to investigate factors involved in the manufacture of representative products.
9. To develop an awareness of vocations in manufacturing industries.

10. To develop responsible and safe work attitudes and the ability to function as a member of a group.
11. To develop an awareness of self-realization and generate self-activating behaviors.

INPUT

1. Level 1 Concept II

   The learner will be able to identify three elements of manufacturing input.

2. The learner will be able to identify the function of market, resources, product development, for Manufacturing Technology.

PROCESSES

1. Level 1 Concept II

   The learner will be able to identify three elements of manufacturing processes.

2. The learner will be able to identify the function of pre-processing, processing and post-processing for Manufacturing Technology.

OUTPUT

1. Level 1 Concept III

   The learner will be able to identify two elements of manufacturing output.

2. The learner will be able to identify the function of and limitations of manufactured products.

MANUFACTURING TECHNOLOGY

CURRICULUM STRUCTURE

1.00 ELEMENTS OF MANUFACTURING INPUT

- 1.10 Market
  - 1.11 Demand
  - 1.12 Supply
- 1.20 Resources
  - 1.21 Human
    - 1.211 Management
    - 1.212 Labor
  - 1.22 Materials
    - 1.221 Organic
    - 1.222 Inorganic
  - 1.23 Capital
    - 1.231 Stocks
    - 1.232 Bonds
- 1.30 Product Development
  - 1.31 Engineering
  - 1.32 Designing

2.00 ELEMENTS OF MANUFACTURING

- 2.10 Pre-Processes
  - 2.11 Market survey
  - 2.12 Tooling up for production
  - 2.13 Production prototype
- 2.20 Processing
  - 2.21 Casting
  - 2.22 Forming
  - 2.23 Subtractive
  - 2.24 Fab/Assembly
  - 2.25 Finishing
- 2.30 Post Processing
  - 2.31 Quality control
  - 2.32 Packaging
  - 2.33 Dissemination
  - 2.34 Recycle

3.00 ELEMENTS OF MANUFACTURING OUTPUT

- 3.10 Non-durable goods
  - 3.11 Consumer goods
- 3.20 Durable goods
  - 3.21 Tools and machines

MANUFACTURING TECHNOLOGY

GUIDELINES FOR IMPLEMENTATION

The committee has arrived at the following curriculum structure for the cluster area of manufacturing. It was the goal of the committee to arrive at a structure that would:

1. serve as a transitional state to the new state curriculum guide, and
2. retain quality aspects of those existing industrial arts programs.

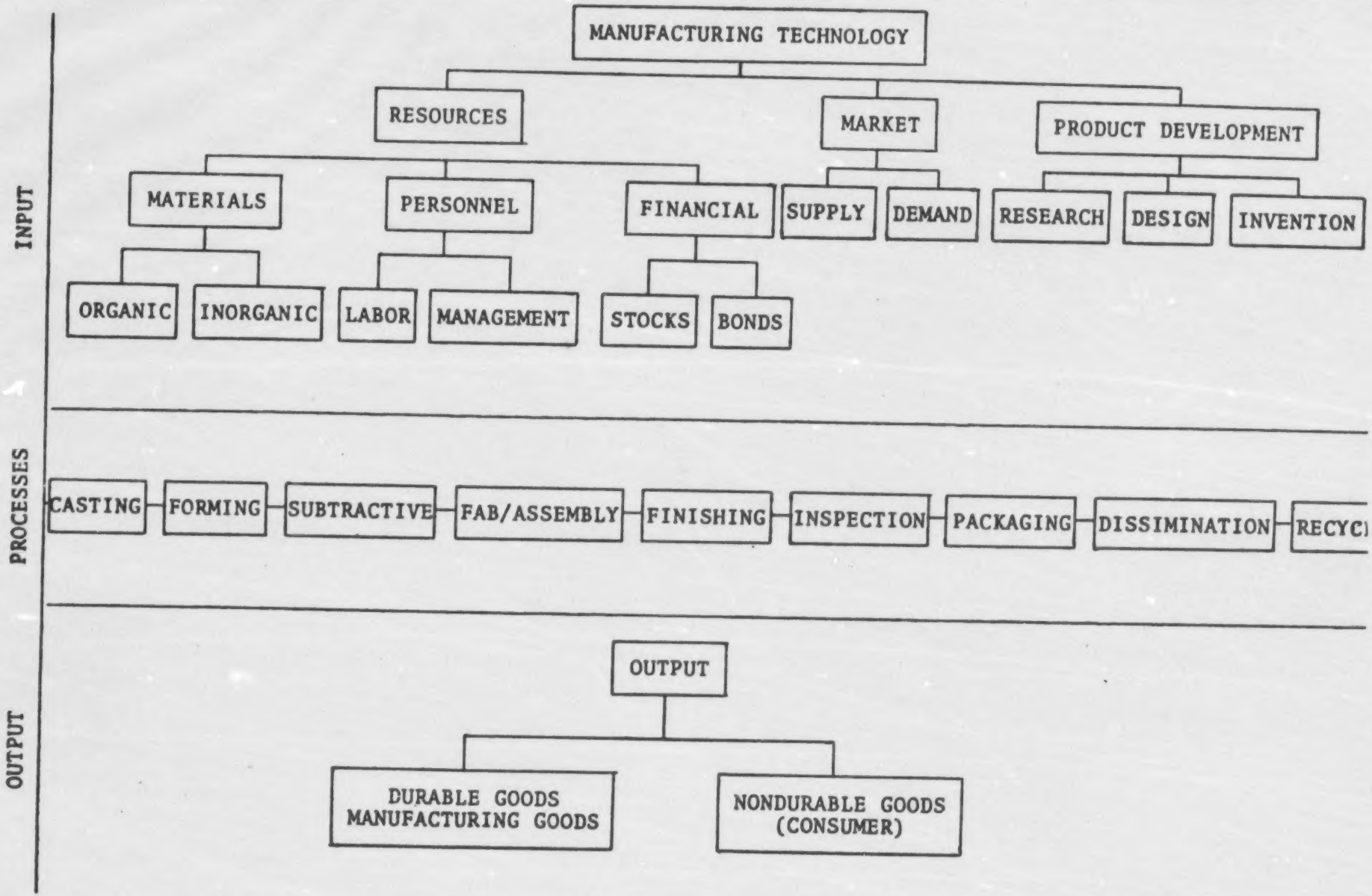
The committee felt the following program was structured sufficiently for teacher guidance as well as provide internal flexibility for individual teachers and local consideration.

The curriculum guide contains a conceptual framework as well as units and subordinate units, goals, objectives, and general sample activities. Each of the major units included are followed by supporting materials. The recommended days for each unit were based on 50 minute periods; and the total time spent, regardless of class period length, may also vary in actual teaching situations depending on individual teacher emphasis.

In addition to the preceeding procedures, the following recommendations were identified by the committee to be considered before implementation:

1. Each teacher should develop specified daily lesson plans from each of the units and specify activities and points for discussion.

2. Each teacher should examine the recommended days for each unit and divide the time for each of the subordinate units.
3. Each teacher should continually reinforce the concept of manufacturing by refering to individual student "projects" as prototypes.
4. Each teacher should devise their own evaluation methods for measuring student progress.
5. Each teacher should consider the sequential order of the units as suggested and may be changed to meet individual school needs.
6. Each teacher should have as a resource a Industrial Arts Curriculum Project software set for the World of Manufacturing.
7. Each teacher should have the IACP World of Manufacturing transparency set and additional sources such as:
    1. Educator's guide to free filmstrips
    2. Educator's guide to free films
    3. Educator's guide to free tapes and scripts
    4. North Dakota Film Library.
8. Each teacher should consider other materials in addition to the woods, metals, and plastics developed in this curriculum.
9. Each teacher should consult the IACP World of Manufacturing price list and worksheet for tools, equipment, and supplies.


MANUFACTURING TECHNOLOGY
RESOURCES
MARKET
PRODUCT DEVELOPMENT
MATERIALS
PERSONNEL
FINANCIAL
SUPPLY
DEMAND
RESEARCH
DESIGN
INVENTION
ORGANIC
INORGANIC
LABOR
MANAGEMENT
STOCKS
BONDS
INPUT
PROCESSES
CASTING
FORMING
SUBTRACTIVE
FAB/ASSEMBLY
FINISHING
INSPECTION
PACKAGING
DISSIMINATION
OUTPUT
OUTPUT
DURABLE GOODS
MANUFACTURING GOODS
NONDURABLE GOODS
(CONSUMER)

MANUFACTURING TECHNOLOGY

BODY OF KNOWLEDGE

1.00 STRUCTURE OF MANUFACTURING INDUSTRY

- 1.10 Four Essentials
  - 1.11 Natural resources
  - 1.12 Capital
  - 1.13 Labor
  - 1.14 Management
- 1.20 Free Enterprise System
- 1.30 Forms of Ownership
  - 1.31 Proprietorship
  - 1.32 Partnership
  - 1.33 Corporation
- 1.40 Labor and Management
  - 1.41 Managerial
  - 1.42 Non-managerial
  - 1.43 Labor relations

2.00 ELEMENTS OF MANUFACTURING

- 2.10 Types of Manufacturing
  - 2.11 Intermittent
  - 2.12 Continuous (mass-production)
- 2.20 Research
- 2.30 Product Design
- 2.40 Product Engineering
- 2.50 Process Engineering
- 2.60 Tooling
- 2.70 Plant Layout
- 2.80 Purchasing
- 2.90 Production Control
- 2.100 Quality Control
- 2.110 Distribution and Service
- 2.120 Personnel Management

3.00 MASS PRODUCTION AND AUTOMATION

- 3.10 Standardization
- 3.20 Tools and Machines
  - 3.21 Jigs
  - 3.22 Fixtures
- 3.30 Material Handling
- 3.40 Assembly Systems
- 3.50 Lead Time and Profit
- 3.60 Automation
- 3.70 Safety

4.00 PRIMARY METALS INDUSTRY

- 4.10 Refining Iron
  - 4.11 Raw materials
  - 4.12 Blast furnace
  - 4.13 Cast iron
- 4.20 Steel
  - 4.21 Open hearth furnace
  - 4.22 Electric furnace
  - 4.23 Basic oxygen furnace
  - 4.24 Pouring ingots
  - 4.25 Continuous casting
  - 4.26 Rolling mills
- 4.30 Non Ferrous Metals
  - 4.31 Aluminum
  - 4.32 Copper
  - 4.33 Lead
  - 4.34 Tin
  - 4.35 Zinc
- 4.40 Alloying
- 4.50 Testing and Research

5.00 CASTING METAL

- 5.10 Patterns and patternmaking
- 5.20 Core and Core Making
- 5.30 Machine Molding

5.40 Casting Processes
- 5.41 Green sand casting
- 5.42 Die casting
- 5.43 Centrifuged casting
- 5.44 Investment casting
- 5.45 Shell molding
- 5.46 Plaster mold casting

5.50 Cleaning and finishing

6.00 FORMING METAL

6.10 Forging
- 6.11 Drop forging
- 6.12 Press forging
- 6.13 Cold forging

6.20 Extrusion

6.30 Powder Metallurgy

6.40 Shearing

6.50 Drawing

6.60 Bending

6.70 Foil forming

6.80 Spinning

6.90 High energy rate forming

7.00 MEASURING AND LAYOUT (ENGLISH AND/OR METRIC)

7.10 Linear Dimension

7.20 Angular Dimension

7.30 Surface Dimension

8.00 MACHINING METAL

8.10 Sawing

8.20 Turning

8.30 Milling

8.40 Shaping

8.50 Drilling

8.60 Grinding

8.70 Recent Techniques

9.00 FASTENING AND FINISHING METAL

9.10 Welding
- 9.11 Arc welding
- 9.12 Oxy-acetylene welding
- 9.13 Resistance welding

9.20 Brazing

9.30 Soldering

9.40 Heat treating
- 9.41 Annealing
- 9.42 Hardening
- 9.43 Casehardening
- 9.44 Tempering

9.50 Adhesive Bonding

9.60 Sheet Metal Assembly

9.70 Mechanical Fasteners
- 9.71 Threaded
- 9.72 Non-threaded

9.80 Polishing and Buffing

9.90 Coatings
- 9.91 Hot dipping
- 9.92 Electroplating
- 9.93 Organic
  - 9.931 Enamel
  - 9.932 Lacquer

10.00 LUMBERING AND FOREST PRODUCTS

10.10 Characteristics

10.20 Classifications
- 10.21 Hardwoods
- 10.22 Softwoods

10.30 Lumbering
- 10.31 Sawing
- 10.32 Seasoning
- 10.33 Surfacing
- 10.34 Grading

10.40 Plywood

10.50 Hardboard

10.60 Particle Board

11.00 CUTTING AND SHAPING WOOD

11.10 Planning

11.20 Sawing

11.30 Drilling and Boring

11.40 Turning

11.50 Routing and shaping

11.60 Sanding

11.70 Bending and Laminating

12.00 ASSEMBLING AND FINISHING WOOD

12.10 Wood Joints

12.20 Adhesives

12.30 Mechanical Fasteners
- 12.31 Threaded
- 12.32 Non threaded

12.40 Assembly Procedures

12.50 Wood Finishes
- 12.51 Coloring
- 12.52 Coating

13.00 PLASTIC MATERIALS AND PROCESSES

13.10 Classification
- 13.11 Thermoplastic plastic
- 13.12 Thermosetting plastic

13.20 Molding
- 13.21 Compression
- 13.22 Transfer
- 13.23 Injection
- 13.24 Plastic foam
- 13.25 Blow

13.30 Extrusion

13.40 Thermoforming

13.50 Casting

13.60 Fabricating and Finishing

14.00 CAREER OPPORTUNITIES IN MANUFACTURING

14.10 Levels of Employment
- 14.11 Professional
- 14.12 Skilled
- 14.13 Semi-skilled
- 14.14 Unskilled

14.20 Personnel Practices
- 14.21 Recruiting
- 14.22 Hiring
- 14.23 Training
- 14.24 Working
- 14.25 Advancement
- 14.26 Retirement

14.30 Outlook

MAJOR UNITS

MANUFACTURING TECHNOLOGY

1.00	STRUCTURE OF INDUSTRY	3 Days
2.00	ELEMENTS OF MANUFACTURING	5 Days
3.00	MASS PRODUCTION AND AUTOMATION	8 Days
4.00	PRIMARY METALS INDUSTRY	3 Days
5.00	CASTING METAL	5 Days
6.00	FORGING AND FORMING METAL	8 Days
7.00	MEASURING AND LAYOUT (ENGLISH AND/OR METRIC)	2 Days
8.00	MACHINING AND FINISHING METAL	8 Days
9.00	FASTENING AND FINISHING METAL	8 Days
10.00	LUMBERING AND FOREST PRODUCTS	3 Days
11.00	CUTTING AND SHAPING WOOD	15 Days
12.00	ASSEMBLING AND FINISHING WOOD	10 Days
13.00	PLASTIC MATERIAL AND PROCESSES	10 Days
14.00	OPPORTUNITIES IN MANUFACTURING	2 Days

UNIT I

1.00 STRUCTURE OF MANUFACTURING INDUSTRY 3 Days

OBJECTIVE: At the end of this unit, the student will be able to:

A. identify the four essentials of the manufacturing industry

B. list and explain the three forms of ownership

C. give examples of long-range and short range planning that families do.

UNIT OUTLINE

1.10 Four Essentials

1.11 Natural resources

1.12 Capital

1.13 Labor

1.14 Management

1.20 Free Enterprise System

1.30 Forms of Ownership

1.31 Proprietorship

1.32 Partnership

1.33 Corporation

1.40 Labor and Management

1.41 Managerial

1.42 Non-managerial

1.43 Labor relations

UNIT NO. I	SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
1.00	STRUCTURE OF MANUFACTURING THE STUDENT WILL BE ABLE TO:	
1.10	A. Identify the four manufacturing elements.	A1. The students will discuss the four essentials of the manufacturing industry.
1.20	A. Demonstrate the principle of supply and demand.	A2. The student will state how the demand for a product effects the supply
1.30	A. Name and explain the three forms of ownership.	A3. The student will discuss the advantages and disadvantages of the different types of ownership.
1.40	A. Demonstrate the relationship between labor and management.	A4. The student will identify several planning, organizing, and controlling functions of management which are necessary for manufacturing a specified product. B4. The student will identify several of the working activities necessary for manufacturing a specified product.

CONSTRUCTION TECHNOLOGY

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LEARNING EXPERIENCES.....viii

CONSTRUCTION TECHNOLOGY

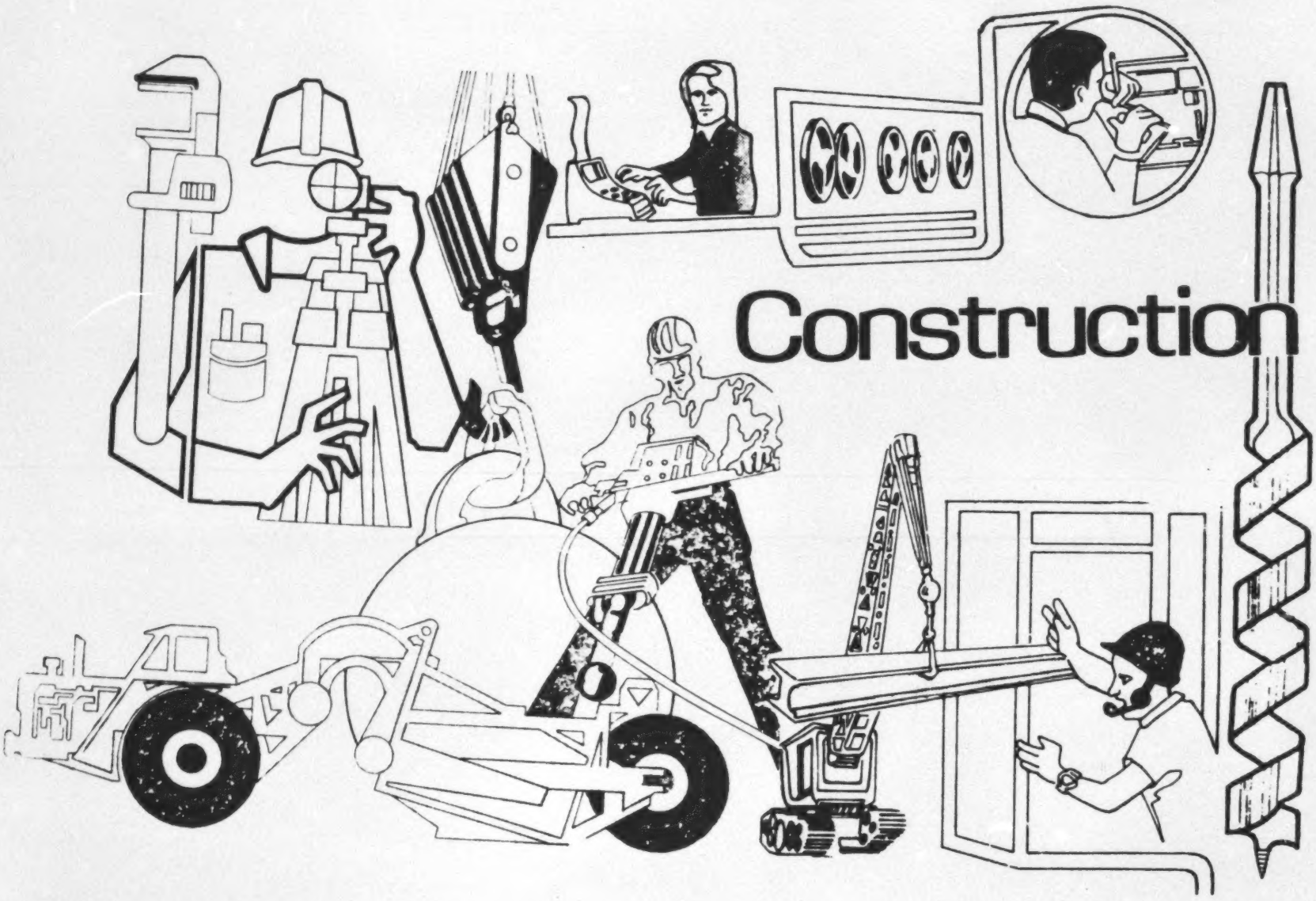
RATIONALE.....3
OBJECTIVES.....4
CURRICULUM STRUCTURE.....5
BODY OF KNOWLEDGE.....7
MAJOR UNITS.....10

COURSE CONTENT

UNIT I INTRODUCTION TO CONSTRUCTION TECHNOLOGY.....1.1
UNIT II PRE-CONSTRUCTION.....2.1
UNIT III CONSTRUCTION.....3.1
UNIT IV POST CONSTRUCTION.....4.1

INSTRUCTIONAL AIDS/MATERIALS/EQUIPMENT

VISUAL AIDS.....5.1
TEACHING AIDS & SPECIAL EQUIPMENT.....5.5
TOOLS & EQUIPMENT.....5.6
LIST OF EXPENDABLE MATERIALS.....5.10
TRANSPARENCY MASTERS.....5.17


Construction

CONSTRUCTION TECHNOLOGY

RATIONALE: The development of the Construction Technology cluster has evolved from the industrial technology body of knowledge. The industrial technology is comprised of three major components:

1. general building construction,
2. civil engineering works
3. prefabrication of construction components.

The purpose of studies of this construction technology cluster are to provide students, through activity-oriented instion, with; the broad context of general wood building construction; selected practices in pre construction, construction, and post construction for future development as a part of man's existence. Studies within this cluster are complimented with both manipulative and experimental student conducted laboratory activities, or educator demonstration, which emphasize the technical aspects inherent and, also, empress upon the student the; socioeconomic, environmental, safety, efficiency, and career aspects of this cluster.

More specifically, the educational purposes of this instructional cluster are to provide students with:

1. the broad context of construction technology within the context of the industrial technology
2. selected practices in pre construction
3. an understanding of construction activity and utilization of tools and materials
4. an application of the construction methods and

5. the significance of self realization and self-activating behaviors for future learning in professional or technical fields.

OBJECTIVES: Primary objectives of Construction Technology are to:

1. Place Construction Technology in the broad context of industrial technology.
2. Provide selected Construction Technology activities for the development of attitudes, appreciation, and understanding in an introduction to construction, pre construction, construction, and post construction.
3. Develop an awareness of self-realization and generate self-activating behaviors.
4. Develop an understanding of construction activities and the tools and materials utilized in their construction.
5. Relate the activities of construction technology to local, state, and national developments.
6. Utilize knowledge of past, present and future techniques outside the classroom.

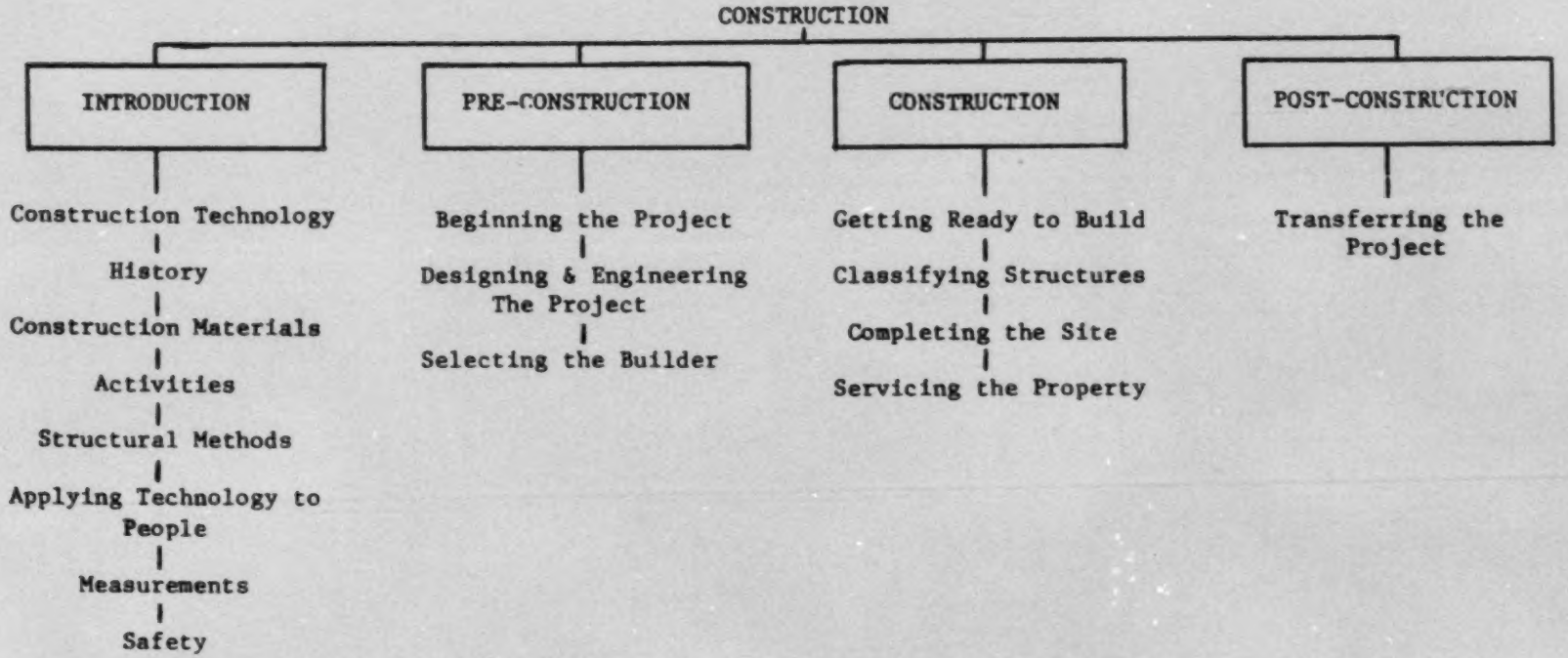
CONSTRUCTION TECHNOLOGY

CURRICULUM STRUCTURE

This course is designed to provide students with an opportunity to better understand Construction Technology within the broader context of industrial technology, and to provide education-technical professional guidance. It provides the student with learning experiences related to construction concepts; the history, pre construction, construction, and past construction stages. The learning experiences are for all students.

8th or 9th grade

18 weeks


CONSTRUCTION
INTRODUCTION
PRE-CONSTRUCTION
CONSTRUCTION
POST-CONSTRUCTION
Construction Technology
History
Construction Materials
Activities
Structural Methods
Applying Technology to People
Measurements
Safety
Beginning the Project
Designing & Engineering The Project
Selecting the Builder
Getting Ready to Build
Classifying Structures
Completing the Site
Servicing the Property
Transferring the Project

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CONSTRUCTION TECHNOLOGY

BODY OF KNOWLEDGE

1.00 INTRODUCTION TO CONSTRUCTION TECHNOLOGY

- 1.10 Construction Technology
  - 1.11 Construction management
  - 1.12 Construction personnel
  - 1.13 Construction processes
  - 1.14 Construction materials
- 1.20 History of Building Construction
  - 1.21 Development of architectural styles
- 1.30 Construction Materials
  - 1.31 Concrete
  - 1.32 Metal
  - 1.33 Wood
  - 1.34 Synthetics
- 1.40 Construction Activities
- 1.50 Structural Methods
  - 1.51 Post and lintel
  - 1.52 Arch
  - 1.53 Vault
  - 1.54 Dome
  - 1.55 Truss
  - 1.56 Frame
- 1.60 Applying Construction Technology to People
  - 1.61 Construction technology careers
  - 1.62 Advancing in construction (Oct. 28, W. O. C.)
- 1.70 Construction Technology and the International System of Measurement
  - 1.71 Introduction to measurement
  - 1.72 Measurement in the U.S.
  - 1.73 Systems International units of measure
  - 1.74 Seven base units
    - 1.741 Derived units
    - 1.742 Supplemental units
    - 1.743 Non-SI units
    - 1.744
  - 1.75 Prefixes
    - 1.751 Using the prefixes
    - 1.752
  - 1.76 Drawing to scale
  - 1.77 SI scales for construction and map drawing
  - 1.78 Useful conversions

1.80 Construction Technology and Safety
- 1.81 Introduction to safety and technology
- 1.82 Personal protection equipment
  - 1.821 Protective hard hat
  - 1.822 Protective foot wear
  - 1.823 Protective hearing devices
  - 1.824 Protective eye shields
  - 1.825 Protective dust respirators
  - 1.826 Protective work gloves
  - 1.827 Protection against falling
- 1.83 Scaffolds

2.00 PRE-CONSTRUCTION

2.10 Beginning the Project
- 2.11 Selecting the site
- 2.12 Buying real estate
- 2.13 Surveying and mapping
- 2.14 Soil testing

2.20 Designing and Engineering the Project
- 2.21 Identifying design problems
- 2.22 Analyzing the design
- 2.23 Designing and engineering cycle

2.30 Selecting the Builder
- 2.31 Contracting
- 2.32 Estimating and bidding
- 2.33 Scheduling

3.00 CONSTRUCTION

3.10 Getting Ready to Build
- 3.11 Clearing the site
- 3.12 Locating the structure
- 3.13 Earth moving
- 3.14 Stabilizing earth and structures
- 3.15 roughing in utilities

3.20 Classifying Structures
- 3.21 Setting foundations
- 3.22 Building forms
- 3.23 Setting reinforcements
- 3.24 Mixing concrete
- 3.25 Placing and finishing concrete
- 3.26 Completing foundations
- 3.27 Building super structure
- 3.28 Building mass and masonary super structure
- 3.29 Building wood frames
- 3.210 Installing utilities
- 3.211 Enclosing framed super structure
- 3.212 Finishing the project

3.30 Completing the Site

3.40 Servicing the Property

4.00 POST-CONSTRUCTION

4.10 Transferring the Project

CONSTRUCTION TECHNOLOGY

MAJOR UNITS

1.00 INTRODUCTION TO CONSTRUCTION TECHNOLOGY . . . . . .

2.00 PRE-CONSTRUCTION . . . . . .

3.00 CONSTRUCTION . . . . . .

4.00 POST-CONSTRUCTION . . . . . .

UNIT I

1.00 INTRODUCTION TO CONSTRUCTION TECHNOLOGY

1.10 Construction Technology

1.11 Construction management

1.12 Construction personnel

1.13 Construction processes

1.14 Construction materials

1.20 History of Building Construction

1.21 Development of architectural styles

1.30 Construction Materials

1.31 Concrete

1.32 Metal

1.33 Wood

1.34 Synthetics

1.40 Construction Activities

1.50 Structural Methods

Objective: At the end of this unit, the student will be able to:

1. relate construction to the broad range of human activities
2. Identify several natural resources as building material
3. give a general explanation of what is a construction material.

UNIT OUTLINE

1.51 Post and lintel

1.52 Arch

1.53 Vault

1.54 Dome

1.55 Truss

1.56 Frame

1.60 Applying Construction Technology to People

Objective: At the end of this unit, the student will be able to:

1. identify some of the responsibilities a contractor has other than making sure the correct materials are used.
2. name which of the following groups, in a contractors office, you would choose to work in and explain why you chose it:
   a) Administrative
   b) Engineering
   c) Construction

UNIT OUTLINE

1.61 Construction technology careers

1.62 Advancing in construction (Act 28, OSHA)

1.70 Construction Technology and the International System of Measurement

Objective: At the end of this unit, the student will be able to:

1. recognize the International SI Metric System of Measurement
2. give a brief history of the metric form of measurement
3. give the basis for the US change over to metric
4. give an explanation of the seven base units and the common derived units of area and volume
5. give an explanation of the use of prefixes
6. give a showing of the basic manipulative concepts of base

temperature

UNIT OUTLINE

1.71 Introduction to measurement

1.72 Measurement in the U.S.

1.73 Systems International units of measure

1.741 Derived units

1.742 Supplemental units

1.743 Non-SI units

1.744

1.75 Prefixes

1.751 Using the prefixes

1.752

1.76 Drawing to scale

1.77 Si scales for construction and map drawing

1.78 Useful conversions

1.80 Construction Technology and Safety

Objective: At the end of this unit, the student will be able to:

1. list safety practices related awareness
2. list potential harmful and hazardous conditions, to health an environment
3. know the significance of the Williams-Steger Act, better known as the Occupational Safety and Health Act (OSHA)
4. List personal protective equipment

UNIT OUTLINE

1.81 Introduction to safety and technology

1.82 Personal protective equipment

1.821 Protective hard hat

1.822 Protective foot wear

1.823 Protective hearing devices

1.824 Protective eye shields

1.825 Protective dust respirators

1.826 Protective work gloves

1.827 Protection against falling

1.83 Scaffolds

UNIT NO. I	SELECTED STUDENT COMPETENCIES	SELECTED STUDENT LEARNING ACTIVITIES
1.00	INTRODUCTION TO CONSTRUCTION TECHNOLOGY THE STUDENT WILL BE ABLE	
1.50	A. Identify the post and lintel, arch and truss as a structural system.	A5. Assemble the post and lintel model, assemble blocks to form an arch, and assemble the truss section.
	B. Describe the effects of a downward force on the post and lintel, arch and truss systems of spanning spaces.	B5. Observe that weaker material used for the lintel requires that posts be set close together.
	C. Identify the nature of supporting loads inherent in building.	C5. Observe that the arch will withstand downward thrust only equal to the massive weight of the supporting posts, and observe that the truss is a very stable design.
1.60	A. Choose a technical career or professional position.	A6. Identify the technical or professional area you've choosen.
	B. Find the appropriate total income for beginning salaries for each additional year up to ten years.	B6. Identify the salary or wage for career choosen. C6. Determine the duration of educational preparation
1.70	A. Identify and use the following measurement units: 1. Lined measure-the metro 2. Areas measure-the square metro 3. Mass measure-the kilogram 4. Temperature-the degree Celsius 5. Volume measure- a. liquid-the litro b. solid-the cubic metro	A7. Given the proper tools: a. measure the following quantities: 1. length, area, and volume 2. mass, weight 3. temperature b. using the metric stick, measure the length and width of the classroom and record the distance in meters c. from the above measurement, calculate the

UNIT NO. I	SELECTED STUDENT COMPETENCIES	SELECTED STUDENT LEARNING ACTIVITIES
1.00	CON'T	
1.70	Con't	c. from the above measurement, calculate the area of the floor space. d. read and record the temperature of the Celsius thermometer.
1.80	A. List safety practices related awareness.	A8. Discuss the kinds of attitudinal developments required to work safely in construction.
	B. List potential harmful and hazardous conditions to health and environment.	B8. In the community, observe and identify potential unsafe conditions to health and environment.
	C. Know the significance of the Williams-Steger Act, better known as the Occupational Safety and Health Act (OSHA).	C8. Discuss the significance of OSHA.
	D. List personal protective equipment.	D8. Observe careless practices regarding the use of personal protective equipment.

1.00 SELECTED RESOURCES

TEXT: Landers, Jack M. Construction, Goodheart and Wilcox Publishing Company, Inc., Chicago, IL, 1976

Landers, Jack M. Construction Laboratory Manual, Goodheart and Wilcox Publishing Company, Inc., Chicago, IL, 1976.

REFERENCES: The World of Construction, Teachers Guide, IACP, McKnight and McKnight Publishing Co., Bloomington, IL, 1970.

Construction Careers

ENERGY/POWER TECHNOLOGY

STATE GUIDE

MASTER WORK COPY

ENERGY/POWER TECHNOLOGY

RATIONALE: The purpose of studies in the Energy/Power cluster area is to develop a realization, through activity-oriented instruction, that the six forms of energy; their availability, conversion, efficient usage, and future development are essential to man's existance. Studies within this cluster area are complimented with both manipulative and experimental student-conducted activities, or teacher demonstrations, which emphasize the technical phenomenon involved and also impress upon the student the socioeconomic and environmental impact of energy usage and the safety, efficiency, and occupational aspects inherent in the Energy/Power field.

The seven major units of course content of the study cluster provide a means of effectively covering most Energy/Power Technology concepts at the middle school level. Four of the seven major units follow a pattern of identifying subconcepts in accord with the six forms of energy (chemical, electrical, light, mechanical, nuclear, and thermal) which are initially encountered in unit three. Thus, a broad coverage of Energy/Power, including "alternative sources for the future," is made possible without specifying any particular form as more applicable to the past, present, or future, The "sources" and "forms" distiction of the third unit is significant because, though most of the six "forms" have been used extensively throughout man's history and no form is presently scarce, some "sources" of several "forms" are becoming more scarce, thereby necessitating serious research regarding future alternative sources.

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ENERGY/POWER TECHNOLOGY

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UNIT II SAFETY CONCEPTS IN ENERGY/POWER WORK.....2.1
UNIT III FORMS AND SOURCES OF ENERGY.....3.1
UNIT IV ENERGY HARNESSING SYSTEMS.....4.1
UNIT V ENERGY/POWER TRANSMISSION AND CONTROL.....5.1
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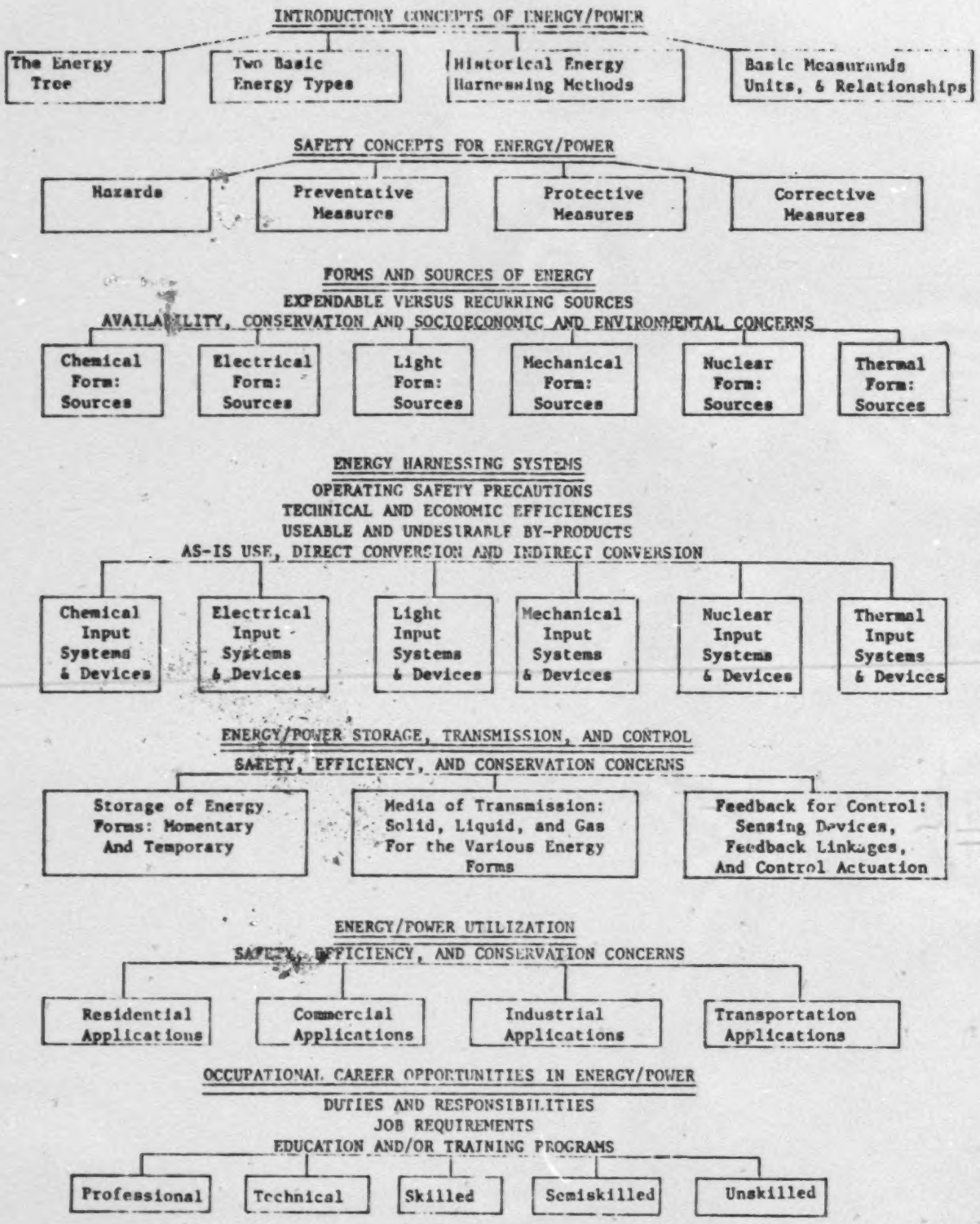
OBJECTIVES: The primary objectives of the Energy/Power Technology cluster are:

1. To develop an insight and understanding of the broad Energy/Power field and its importance in our society.
2. To discover and develop attitudes, interests, and individual potentials related to the Energy/Power industry through problem solving using tools and products of industry.
3. To develop career awarness through pre-vocational experiences and information relating to the world of energy and power.
4. To facilitate wise utilization of energy and power as a consumer.
5. To develop abilities in the safe and proper use of energy and associated substances, materials, and/or devices.

ENERGY/POWER TECHNOLOGY
TAXONOMETRIC STRUCTURE



ENERGY/POWER TECHNOLOGY

MAJOR UNITS

1.00	INTRODUCTORY CONCEPTS IN ENERGY/POWER	5 Days
2.00	SAFETY CONCEPTS IN ENERGY/POWER WORK	3 Days
3.00	FORMS AND SOURCES OF ENERGY	24 Days
4.00	ENERGY HARNESSING SYSTEMS	24 Days
5.00	ENERGY/POWER TRANSMISSION AND CONTROL	24 Days
6.00	ENERGY/POWER UTILIZATION	5 Days
7.00	OCCUPATIONAL CAREER OPPORTUNITIES IN ENERGY/POWER . .	3 Days

ENERGY/POWER TECHNOLOGY

BODY OF KNOWLEDGE

1.00 INTRODUCTORY CONCEPTS IN ENERGY/POWER

- 1.10 The Energy Tree (Sun as Origin)
  - 1.11 Light → heat →
  - 1.12 Chemical reaction → vegetation →
  - 1.13 Chemical reaction → fossil fuels → etc.
  - 1.14 The necessity of conservation and research
- 1.20 Two Basic Energy Types
  - 1.21 Kinetic
  - 1.22 Potential
- 1.30 Historical Harnessing and Uses of Energy
  - 1.31 Muscle power
  - 1.32 Water and wind
  - 1.33 Heat and steam
- 1.40 Basic Measurands, Units and Interrelationships
  - 1.41 Energy (Joule)
  - 1.42 Power (Watt)
  - 1.43 Force (Newton)
  - 1.44 Torone (Newton Meter)
  - 1.45 Pressure (Pascal)
  - 1.46 Thermal Energy (Calorie)

2.00 SAFETY CONCEPTS IN THE ENERGY/POWER FIELD

- 2.10 Hazards
  - 2.11 Chemical
  - 2.12 Electrical
  - 2.13 Mechanical
  - 2.14 Radiation
  - 2.15 Thermal
- 2.20 Preventative Measures
  - 2.21 Attitudes
  - 2.22 Knowledge of correct usage
  - 2.23 Equipment
  - 2.24 Facilities
- 2.30 Protective Measures
  - 2.31 Appareal
  - 2.32 Containers
  - 2.33 Shielding (eyes, face, insulative, etc.)
  - 2.34 Grounding and/or appropriate mounting

2.40 Corrective Measures
- 2.41 Extinguishers
- 2.42 Inhibitors
- 2.43 Neutralizers

3.00 FORMS AND SOURCES OF ENERGY

3.10 Chemical
- 3.11 Fossil fuels
  - 3.111 Coal
  - 3.112 Oil
  - 3.113 Natural gas
- 3.12 Biofuels
  - 3.121 Biomass
  - 3.122 Agriculture
  - 3.123 Aquaculture
  - 3.124 Methane
  - 3.125 Alcohol
  - 3.126 Wood

3.20 Electrical
- 3.21 Electrostatic
  - 3.211 Friction
  - 3.212 Lightning
- 3.22 Magnetic

3.30 Light
- 3.31 Solar
  - 3.311 Heliochemical
  - 3.312 Helioelectrical
  - 3.313 Heliothermal
- 3.32 Radioactive

3.40 Mechanical
- 3.41 Wind
  - 3.411 Climate and Astmospheric Conditions
  - 3.412 Wind Driven Generators
  - 3.413 Environmental
  - 3.414 Battery, storage and capacity
  - 3.415 Generators and alternators
  - 3.416 Blades and hubs
- 3.42 Water
  - 3.421 Tidal
  - 3.422 Waves
  - 3.423 Economics
  - 3.424 Environmental considerations
  - 3.425 Water rights
  - 3.426 Measuring available water power
  - 3.427 Dams
  - 3.428 Large and small flows
  - 3.429 Channels, sluices and pipes
  - 3.4210 Water wheels and water turbines
  - 3.4211 Power transmission

3.43 Gravitational

3.50 Nuclear
- 3.51 Atomic, radioactive
  - 3.511 Atomic theory
  - 3.512 Law of conservation of energy
  - 3.513 Chemical energy
  - 3.514 Electrons and energy
  - 3.515 Nuclear fuels
  - 3.516 Reactor principle and power
- 3.52 Solar
  - 3.521 Energy of sun
  - 3.522 Energy of radioactivity
  - 3.523 Nuclear fission
  - 3.524 Nuclear fusion

3.60 Thermal
- 3.61 Geothermal
- 3.62 Solar
- 3.63 Cryogenic

4.00 ENERGY HARNESSING SYSTEMS

4.10 Direct Versus Indirect Conversions

4.20 For Chemical Energy Input
- 4.21 Fuel cell
- 4.22 Batteries
- 4.23 Fusion
- 4.24 Fission
- 4.25 Sun
- 4.26 Chemical heaters
- 4.27 Internal combustion engines
  - 4.271 Rocket engines
  - 4.272 Jet
  - 4.273 Turbojet
  - 4.274 Fan-jet
  - 4.275 Turbo-prop engines
  - 4.276 Diesel Engines
  - 4.277 Gas and gas turbines
- 4.28 Chemical explosives
  - 4.281 Black powder
  - 4.282 Detonating explosives
- 4.29 Phosphorescence

4.30 For Mechanical Energy Input
- 4.31 Pneumatic driven
  - 4.311 Airmotor
  - 4.312 Windmill
  - 4.313 Wind Turbine
  - 4.314 Sail and sailboats
  - 4.315 Piston devices
    - 4.3151 Jack hammer

4.32 Hydraulic driven
- 4.321 Water Turbine
- 4.322 Hydraulic motor
- 4.323 Piston devices
  - 4.3231 Shock Absorbers or adjustable screen door closers
  - 4.3232 Hydraulic ram

4.33 Pezioelectric effect
4.34 Electric generator

4.40 Electrical Energy Input
- 4.41 Motors
- 4.42 Selenoids
- 4.43 Speakers
- 4.44 Nichrome wire heating element
- 4.45 Crystal
- 4.46 Radio
- 4.47 Television
- 4.48 Heaters
- 4.49 Lights
- 4.410 Refrigerator systems
- 4.411 Laser
- 4.412 Light emitting diode (LED)
- 4.413 Vacuum tubes
- 4.414 Semiconductors
- 4.415 Magnetohydrodynamic generator
- 4.416 Microwave ovens

4.50 Nuclear Energy Input
- 4.51 Nuclear reactors
- 4.52 X-rays
- 4.53 Radioactive isotopes
- 4.54 Nuclear battery

4.60 Thermal Energy Input
- 4.61 Thermostat
- 4.62 Thermo couple (thermoelectric generator)
- 4.63 Thermoinic device
- 4.64 Dissociation
- 4.65 Boiling (water/steam)
- 4.66 Thermoradiation
- 4.67 Thermophotovoltaic Converter (TPV)

(solar dwelling)

4.70 Light Energy Input
- 4.71 Photovotaic cell (solar cell)
- 4.72 Photoconductive cell
- 4.73 Photosynthesis

(solar dwelling)

5.00 ENERGY/POWER STORAGE, TRANSMISSION AND CONTROL

- 5.10 Storage of Energy
  - 5.11 Momentary
    - 5.111 Ignition coil
    - 5.112 Capacitor
    - 5.113 Metal spring
    - 5.114 Etc.
  - 5.12 Temporary
    - 5.121 Battery
    - 5.122 Dam
    - 5.123 Heat storage tank
    - 5.124 Shielded nuclear storage device
    - 5.125 Etc.

- 5.20 Media of Transmission
  - 5.21 Electrical
    - 5.211 Gas
      - 5.2111 Electromagnetic waves
      - 5.2112 Gas filled lamps
      - 5.2113 Gas filled control tubes
      - 5.2114 Etc.
    - 5.212 Solid
      - 5.2121 Conductors, wires, etc.
      - 5.2122 Semiconductors, solid state, etc.
    - 5.213 Liquid
      - 5.2131 Electroplating, ionization
      - 5.2132 Etc.
  - 5.22 Light
    - 5.221 Gas
      - 5.2211 Electromagnetic radiation
      - 5.2212 Etc.
    - 5.222 Solid
      - 5.2221 Transparent and translucent materials
    - 5.223 Liquid
  - 5.23 Thermal
    - 5.231 Gas
      - 5.2311 Conduction
      - 5.2312 Etc.
    - 5.232 Solid
      - 5.2321 Conduction
      - 5.2322 Etc.
    - 5.233 Liquid
      - 5.2331 Conduction
      - 5.2332 Etc.
  - 5.24 Mechanical
    - 5.241 Gas
      - 5.2411 Windmill and wind turbine
      - 5.2412 Sale and sail boats
      - 5.2413 Pneumatic driven and piston devices
      - 5.2414 Etc.

5.242 Solid
5.2421 Belts and drive chains
5.2422 Cams
5.2423 Levers
5.2424 Screws
5.2425 Wheel and axle
5.2426 Couplings
5.2427 Linkages
5.2428 Explosives
5.2429 Etc.
5.243 Liquid
5.2431 Water Turbine
5.2432 Hydraulic driven and piston devices
5.2433 Etc.
5.25 Chemical
5.251 Gas
5.252 Solid
5.253 Liquid
5.26 Nuclear
5.261 Gas
5.262 Solid
5.263 Liquid

5.30 Feedback for Control
5.31 Sensing and sensors (for control purposes)
5.311 Sensed Phenomenon
5.3111 Quantatative sensing
5.3112 Qualitative sensing
5.312 Chemical sensors
5.3121 PH meter (senses ion concentration)
5.3122 Galvanometer (senses potential between metals in an electrolyte solution)
5.3123 Etc.
5.313 Electrical sensors
5.3131 Relay (senses quantity of current)
5.3132 Galvanometer (senses minute voltages)
5.3133 Ammeter and/or voltmeter
5.3134 Oscilloscope
5.314 Light sensors
5.3141 Photovoltaic (solar) cell
5.3142 Photoconductive cell
5.3143 Etc.
5.315 Mechanical sensors
5.3151 Plume Bob
5.3152 Proving ring
5.3153 Strain gauge
5.3154 Preasure gauge (pop-off valve, manometer, etc.
5.316 Nuclear sensors
5.3161 Geiger counter
5.3162
5.317 Thermal sensors
5.3171 Thermostat
5.3172 Thermocouple
5.3173 Etc.

6.00 ENERGY/POWER UTILIZATION (Emphasis on safe, efficient and conservative use in all of the below indicated applications)

- 6.10 Residential
  - 6.11 Light
    - 6.111 Illumination
    - 6.112 Sensing
    - 6.113 Viewing (TV)
    - 6.114 UV lamps
  - 6.12 Thermal
    - 6.121 Climate control
    - 6.122 Liquid and food preparation
    - 6.123 Heat lamps
    - 6.124
  - 6.13 Mechanical
    - 6.131 Motor driven appliances and tools
    - 6.132 Engine driven devices
    - 6.133 Door activation mechanisms

- 6.20 Commercial (Services and Products are Distributed)
  - 6.21 Light
    - 6.211 Illumination
    - 6.212 Sensing
    - 6.213 Image development and viewing (film development & TV)
  - 6.22 Thermal
    - 6.221 Climate control
    - 6.222 Substance heating (ovens, torches, etc.)
    - 6.223 Materials drying
  - 6.23 Mechanical
    - 6.231 Pnumatic driven (motor, piston and turbine devices)
    - 6.232 Hydraulic driven (motor, piston and turbine devices)
    - 6.233 Electric driven (solenoids)
  - 6.24 Nuclear (treatment)

- 6.30 Industrial (Products are produced)
  - 6.31 Light
    - 6.311 Illumination
    - 6.312 Sensing
  - 6.32 Thermal
    - 6.321 Climate control
    - 6.322 Substance heating
  - 6.33 Mechanical
    - 6.331 Pneumatic driven
    - 6.332 Hydraulic driven
    - 6.333 Electric driven
  - 6.34 Nuclear
    - 6.341 Inapection
    - 6.342 Electrical production

6.40 Transportation
- 6.41 Air or space
  - 6.411 Internal combustion (piston, jet, turbine)
- 6.42 Surface
  - 6.421 Internal combustion engines
  - 6.422 External combustion engines
  - 6.424 Muscle
  - 6.425 Gravitational
- 6.43 Liquid
  - 6.431 Internal combustion engines
  - 6.432 Nuclear
  - 6.433 Muscle
  - 6.434 Electric

7.00 OCCUPATIONAL CAREER OPPORTUNITIES IN ENERGY/POWER
(Emphasis on duties, responsibilities, main job requirements and training programs--and including the concept of intercatagory assignments. (i.e. The technician can contribute his skills in the areas of servicing, research and development, maintenance, etc.

7.10 Professional
- 7.11 Engineer/designer
- 7.12 Inventor
- 7.13 Researchers/scientists
- 7.14 Educators
- 7.15 Executives/managers

7.20 Technical
- 7.21 Quality/production supervisor
- 7.22 Engineering assistant
- 7.23 Superintendent/foreman
- 7.24 Drafting/design personnel
- 7.25 Experimental personnel

7.30 Skilled
- 7.31 Electricians
- 7.32 Assemblers
- 7.33 Machinists

7.40 Semi-skilled
- 7.41 On-the-job trainees
- 7.42 Self-improved workers

7.50 Unskilled
- 7.51 Helpers
- 7.52 Laborers
- 7.53 Attendants

UNIT I

1.00 INTRODUCTORY CONCEPTS IN ENERGY/POWER 5 Days

OBJECTIVES: At the end of this unit, the student will be able:

1. To develop an understanding of the sun as the origin of all energy
2. To promote the ability to distinguish between kinetic and potential types of energy
3. To promote an appreciation of the historical methods of harnessing energy
4. To provide for an understanding of the basic measuranda and units associated with energy/power technology and their inter-relationships.

UNIT OUTLINE

1.10 The Energy Tree (sun as origin)

1.11 Light ⟶ heat ⟶

1.12 Chemical reaction ⟶ vegetation ⟶

1.13 Chemical reaction ⟶ fossil fuels ⟶ etc.

1.14 The necessity of conservation and research

1.20 Two Basic Energy Types

1.21 Kinetic

1.22 Potential

1.30 Historical Harnessing and Uses of Energy

1.31 Muscle power

1.32 Water and wind

1.33 Heat and stean

1.40 Basic Measurands, Units and Inter-relationships

1.41 Energy (Joule)

1.42 Power (Watt)

1.43 Force (Newton)

1.44 Torave (Newton Meter)

1.45 Pressure (Pascal)

1.46 Thermal energy (calorie)

UNIT NO. I	SELECTED STUDENT COMPETENCIES	SAMPLE LEARNING ACTIVITIES
1.00	INTRODUCTORY CONCEPTS IN ENERGY/POWER THE STUDENT WILL BE ABLE TO:	
1.10	A. Indentify, list and/or describe the natural progressions of energy from the sun into other forms of energy.	A1. a. Refer to A. at left. A1. b. Demonstrate the transformation of energy by striking a match.
1.20	A. Identify, list and/or describe the two basic types of energy.	A2. a. Identify examples of kinetic and potential in your lab, home, community, etc. A2. b. Discuss the law of conservation of energy, Ex. pendulum. A2. c. How does friction interact with the law of conservation of energy and how this effects the efficiency of a machine. A2. d. Demonstrate how gravity effects the law of conservation of energy.
1.30	A. Identify and list a number of daily activities which are presently common to those activities of years ago.	A3. a. Refer to A. at left.

UNIT NO. I	SELECTED STUDENT COMPETENCIES	STUDENT LEARNING ACTIVITIES
1.00	CON'T	
1.40	A. Differentiate and work with the basic measurands, units and mathematical inter-relationships identified.	A4. a. Demonstrate and calculate torque with a torque wrench or bicycle crank. A4. b. Calculate how much horsepower a person develps in climbing a ladder in a measured period of time. A4. c. Demonstrate and calculate the mechanical advantage of different gear ratios on your bicycle. A4. d. Demonstrate and calculate the amount of pressure that would have to be exerted on a 1 1/8" diameter ram to raise a 1 ton automobile or weight.

CE 010 053